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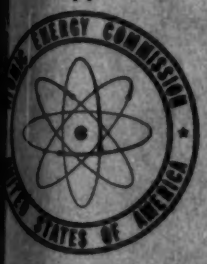

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NUCLEAR SCIENCE ABSTRACTS

Volume 10 November 30, 1956 No. 22

BIOLOGY AND MEDICINE

RADIATION HAZARDS AND PROTECTION

10995
RADIOACTIVE SEDIMENTS IN THE TENNESSEE RIVER SYSTEM. J. M. Garner, Jr. (Oak Ridge National Lab., Tenn.) and Oscar W. Kochtitzky (Tennessee Valley Authority, Chattanooga). J. Sanitary Eng. Div. Am. Soc. Civil Engrs. 82, SA 4, Paper 1051, Aug. 1956. 20p.

Radioactive materials are known to be absorbed by biological organisms, adsorbed on clay particles occurring as turbidity in streams, or precipitated by other physical or chemical means thus resulting in the accumulation of radioactive substances in the sediment. The purpose of the surveys was to determine: the extent of dispersion of radioactive materials in river sediment; the level of radiation encountered and consequent external hazard to humans; the amount of present accumulations and predicted future accumulations; the capacity of the TVA system of lakes as a place of permanent disposal; and the validity of the present policy of discharging to nature some of the radioactive wastes. Due to the short range of alpha and beta particles in water and in mud any potential external hazard that might be encountered in the sediment would most likely be due to gamma emitters. The instrument, called the "flounder", was developed and used in the surveys for measuring gamma radiation in the water and at the surface of the mud. (auth)

10996
DETERMINATION OF INTERNALLY DEPOSITED RADIOACTIVE ISOTOPES FROM EXCRETION ANALYSES. Wright H. Langham (Los Alamos Scientific Lab., N. Mex.). Am. Ind. Hyg. Assoc. Quart. 17, 305-18(1956) Sept.

10997
METEOROLOGICAL ASPECTS OF ATOMIC RADIATION. Science 124, 105-12(1956) July 20.

Bomb energy, detonation altitude, and atmospheric conditions have significant influences on the mechanism, rate, and pattern of fall-out. These variables are discussed. Also considered is the possibility of an intolerable Kr^{85} concentration in the atmosphere from nuclear power plants. (D. E. B.)

10998
GAMMA-RAY ACTIVITY OF CONTEMPORARY MAN. C. E. Miller and L. D. Marinelli (Argonne National Lab., Lemont, Ill.). Science 124, 122-3(1956) July 20.

Gamma scintillation spectra of humans were prepared at ANL. These spectra show two photo peaks which are attributed to K^{42} and Cs^{137}. (D. E. B.)

10999
A STUDY OF THE PROTECTIVE EFFECT OF DESOXYCORTICOSTERONE ACETATE AND DESOXYCORTICOSTERONE ENANTHATE ON SUPRARENAL CORTEX OF TOTAL X-IRRADIATED ALBINO RATS. Giselbert Suchowsky. Strahlentherapie 99, 577-82(1956) Apr. (In German)

Desoxycorticosterone acetate administered immediately and one hour before total body irradiation produces a protective effect on the dehydrogenase activity in the cortex of the suprarenal gland in rats. Desoxycorticosterone enanthate administered 5 days before the total body irradiation considerably supports the dehydrogenase activity and thus the secretory function of the cortex of the suprarenal gland. (auth)

11000
CONCERNING THE DETECTION OF FUNCTIONAL DISTURBANCE IN CIRCULATION IN AN ISOLATED RABBIT EAR FOLLOWING X IRRADIATION. Paul Erich Gehrels, Hans-Joachin Heite, and Peter Otzen. Strahlentherapie 100, 129-36(1956) May. (In German)

To supplement former investigations the authors have elaborated refined methods to examine the reactivity towards arterenol of the x-rayed rabbit-ear through which, in isolation, tyrode solution was sent at different times after the irradiation. Already before the appearance of an erythema a diminution of the excitability of the constrictors can be proved, the extent of which grows considerably with the forthcoming erythema and which is reversible in vivo after 6 to 8 days. (auth)

11001
THE FAILURE OF RADIATION PROTECTION WITH CYSTEIN, CYSTEAMINE, AND OTHER SULFHYDRYL COMPOUNDS. Hanns Langendorff, Ruprecht Koch, and Ulrich Hagen. Strahlentherapie 100, 137-41(1956) May. (In German)

1 (-) 2-thiolhistidine, 1,3 dithiopropanol, thioacetamide, 4,6-dimethyl-2-mercaptopyrimidine, ortho-aminothiophenol, and dithiopentaerythrite have been examined for their protective effect against x rays in mice exposed to a total roentgen irradiation of 500 r. None of the substances produced a protective effect. In this connection, the authors point to the specific radioprotective effect of the cysteine-cysteamine-bodies as sulfhydryle substances. The increased radiosensibility after thioacetamide results from its hepatotoxic effect. (auth)

11002
EXPERIMENTAL RESEARCH ON THE EFFECT ON ACUTE RADIATION SYNDROME BY GANGLION BLOCKING DRUGS AND OTHER SIMILAR SUBSTANCES. Emil Heinz Graul. Strahlentherapie 100, 142-52(1956) May. (In German)

The present report deals with explorations of so-called ganglion blocking drugs, such as pendiomide, buscopan, penthonium, tetraethyl ammonium chloride, and megaphen as to the possibility of their application for the prophylaxis and therapy of the acute radio-syndrome. Their protective efficiency against rays is not very high; their positive or negative effect depends largely on the interval between their application and the attack of rays. Basing on the present knowledge in radio-biology and of the patho-physiology of the radio-syndrome, the author tries to explain this phenomenon. (auth)

11003
HEMATOLOGICAL RESEARCH ON THE EFFECT OF PROTECTIVE SUBSTANCE. PART I. THE EFFECT OF CYSTEINE ON THE BONE MARROW AFTER TOTAL BODY IRRADIATION. Helmut Hartweg. Strahlentherapie 100, 259-68(1956) June. (In German)

The author reports on hematologic and histologic investigations into the course of the radio-reaction in the bone marrow of albino rats, of which a certain number had been treated with cysteine. A diminution of the primary radiogenic damage by means of cysteine could not be observed.

The animals, however, which had been previously treated with cysteine showed a more rapid and more intense recreation from the attack of rays. The cause of this effect seems to be a protection of higher regulation centres. (auth)

RADIATION SICKNESS

11004
ON DEPRESSOR REFLEX FROM VAGUS NERVE DURING RADIATION SICKNESS. V. F. Cherkasov (Central Research Inst. of Roentgen-Radiology). Med. Radiol. No. 2, 57-64(1956) Mar.-Apr. (In Russian)

11005
STUDIES OF BLOOD PICTURE CHANGES DURING RADIATION SICKNESS. N. A. Kraevskiĭ. Med. Radiol. No. 3, 6-11(1956) May-June. (In Russian)

11006
CREATINURIA IN PREGNANT AND NON-PREGNANT RATS AFTER IRRADIATION. Z. N. Zhakhova and A. D. Braun (Inst. of Gynecology Akad. of Med. Science S.S.S.R.). Med. Radiol. No. 3, 80-5(1956) May-June. (In Russian)

11007
RADIATION SICKNESS IN MICE DURING A REDUCED BAROMETRIC PRESSURE. I. B. Bychkovskaya, G. S. Strelin, and I. V. Shiffer (Central Research Inst. of Roentgen-Radiology). Med. Radiol. No. 3, 85-92(1956) May-June. (In Russian)

RADIOGRAPHY

11008 AMRL-251
Army Medical Research Lab., Fort Knox, Ky.
THALLIUM 204 BETA-EXCITED X-RADIOGRAPHY. J. G. Kereiakes and G. R. Kraft. May 15, 1956. 23p. Project No. 6-59-08-014.

Application of Tl^{204} as a source for β-excited x radiography is discussed. A diagram of a radiographic setup employing Tl^{204} and photographs of typical radiographs are included. These demonstrate that a Tl^{204} source can be used for the production of radiographically applicable x radiation. Results are compared with those obtained using $Sr^{90}-Y^{90}$ as the β source. (C.H.)

11009
EXPERIMENTAL DATA ON PENETRABILITY OF SYNOVIAL MEMBRANE. T. M. Tupikova (Odessa Med. Inst). Med. Radiol. No. 3, 35-42(1956) May-June. (In Russian)

Refer also to abstract 11169.

RADIOTHERAPY

11010
A LINGUAL GOITER TREATED WITH RADIOACTIVE IODINE. J. Einhorn and L. G. Larsson. Acta Radiol. 45 405-13(1956) May.

A case of a large lingual goiter, which appeared eight years after surgical removal of a nodular, partly intrathoracic, goiter, is reported. An exact diagnosis was possible with the aid of I^{131} and it is the first case reported, in which treatment with I^{131} brought about complete macroscopic disappearance of the tongue tumor. (auth)

11011
MONITORING FILTERS IN ROENTGEN THERAPY. R. Thoraeus. Acta Radiol. 45, 414-20(1956) May.

The need and value of a highly constant radiation output in roentgen therapy in general and in rotation therapy in particular are discussed. A monitoring filter designed for this purpose and used in the equipment for precision rotation roentgen therapy at Radiumhemmet is described and illustrated by measuring results. These show that it is possible to keep the output constant to better than ±2 per cent by using a suitable designed monitoring filter. (auth)

11012
THE AFTERTREATMENT OF URINARY TRACT TUMOR WITH ENDOVESICAL RADIOTHERAPY WITH Co^{60}. Robert Erich Schick. Strahlentherapie 99, 510-19(1956) Apr. (In German)

The success of endovesical radiotherapy of urinary tract tumors by means of radiocobalt depends in a high degree on suitable aftertreatment. Special consideration has to be paid to the radiobiological properties of the bladder, in order to avoid the serious radiological cystitis and its feared complications. The control of infections and the removal of necroses are of great importance. (auth)

11013
PRINCIPLES OF Co^{60} THERAPY UNDER SPECIFIC CONDITIONS OF POST OPERATIVE IRRADIATION. Gunther Barth, Friedrich Heinze, and Helmut Riemann. Strahlentherapie 100, 56-61(1956) May. (In German)

In cases in which the close irradiation tube cannot be applied directly to the tumor, the plastobalt method (Co^{60}) offers still favorable possibilities for small space irradiation. Proceeding from a discussion of tumors in the auditory meatus and in the nasal vestibule the authors indicate protheses for the intraoral application of Co^{60} and methods of plastobalt therapy for tumors in the brain, the paranasal sinus, and the larynx, as well as for glandular metastases, cancer fistulas, and extremity tumors. (auth)

11014
USE OF RADIOISOTOPES IN THE DIAGNOSIS AND THERAPY OF BLOOD DISEASE. Ludwig Heilmeyer and Walter Keiderling. Strahlentherapie 100, 169-83(1956) June. (In German)

In the sphere of hematological diagnostics the radioisotopes have proved their fitness for the determination of the circulating total quantity of blood, of the volumes of erythrocytes and plasma, and of the duration of life of erythrocytes, albumins and globulins. The examination of the Fe-metabolism by means of the Fe^{59} constitutes a further enrichment of hematological diagnostics. In the therapeutical sphere of application P^{32} has won the day in the treatment of polycythemia, whereas for leukemias a final judgment is not yet possible. Au^{198} seems to be promising for leukemias with a big splenic tumor or leukemic liver infiltrates. (auth)

11015
CLINICAL ANALYSIS OF RADIOISOTOPIC TREATMENT OF CARCINOMA OF THE DIGESTIVE TRACT. Josef Becker and Kurt Ernst Scheer. Strahlentherapie 100, 184-91(1956) June. (In German)

In the radio-treatment of digestive-tract carcinoma the contact irradiation with radioactive isotopes constitutes a supplement to the usual roentgen or high tension therapy. Its application is possible above all in the highest and lowest sections of the tract. The choice of the technique depends on the possibility of bringing a source of rays of a rather big volume in the closest possible contact to the tumor. The authors quote examples of different methods of irradiation. (auth)

11016
EXPERIMENTAL RESEARCH ON THE EFFECT OF FRACTIONAL IRRADIATION ON SUBCUTANEOUS WALKER CARCINOMAS OF THE RAT UNDER INCREASED OXYGEN PRESSURES. Günther Grüber and Harry Wieland. Strahlentherapie 100, 241-52(1956) June. (In German)

The report deals with experimental investigations

into the irradiation of subcutaneous Walker carcinomas of rats with respiration under increased oxygen partial pressures. The authors have found out that single irradiation produces an increase of the irradiation effect like that of Gray and collaborators and that of Schubert and collaborators. Furthermore, the effect could be strengthened considerably by means of fractionated irradiation. At a pressure of Po_2 = 2 at, and with a fractionation of 4 times 1000 r, the effect of x rays was 3 times as high as that of one single irradiation of the same quantity in air. The authors discuss the results and recommend the use of this method in human tumor therapy. (auth)

11017

ON THE EFFECTS OF RADIOACTIVE IODINE ON THE HYPOPHYSIC AND OVARIES OF MAMMALS. L. A. Kashchenko (Central Research Inst. of Roentgen-Radiology). Med. Radiol. No. 2, 70-5(1956) Mar.-Apr. (In Russian)

11018

COBALT 60 BEAM THERAPY: THREE YEARS EXPERIENCE AT MONTEFIORE HOSPITAL (NEW YORK). Jacob R. Freid, Henry Goldberg, William Tenzel, Clara L. Okrainetz, and M. Isamettin Aral (Montefiore Hospital, New York). Radiology 67, 200-9(1956) Aug.

Cobalt^{60} beam therapy is a practical and valuable addition to the treatment of cancer. Its field of usefulness is greatest for deep-seated lesions. Minimal skin reactions in relation to the high depth dose, low absorption by bone, and mild constitutional effects due to low integral dose are all distinct advantages over conventional irradiation. Although our material was poor, in so far as it consisted principally of advanced cancer, results were encouraging in cancer of the lung, the head and neck, and the cervix and body of the uterus. Patients treated for control of symptoms from metastases responded well. It is hoped that results will improve for inoperable carcinoma of the breast. Response was poor for glioblastoma multiforme. For the treatment of astrocytoma, medulloblastoma, and other less common gliomas, large tumor doses can be administered with only slight risk of permanent epilation. The response of gastrointestinal tumors was generally poor, though symptomatic improvement was marked in some cases of inoperable or recurrent carcinoma of the rectum and rectosigmoid regions. (auth)

Refer also to abstract 11346.

TRACER APPLICATIONS

11019

LABELLED METABOLIC POOLS FOR STUDYING QUANTITATIVELY THE BIOCHEMISTRY OF TOXIC ACTION. F. P. W. Winteringham (Pest Infestation Lab., Slough, Bucks, England). Intern. J. Appl. Radiation and Isotopes 1, 57-65(1956) July.

11020

BEHAVIOUR OF ^{14}C- AND ^{131}I-LABELLED PLASMA PROTEINS IN THE RAT. R. M. Campbell, D. P. Cuthbertson, C. M. Matthews, and A. S. McFarlane (Rowett Inst., Bucksburn, Aberdeenshire and National Inst. for Medical Research, London). Intern. J. Appl. Radiation and Isotopes 1, 66-84 (1956) July.

11021

THE PRODUCTION AND CLINICAL APPLICATIONS OF ^{132}I. G. B. Cook and J. Eakins (Atomic Energy Research Establishment, Harwell, Berks, England) and N. Veall (Guy's Hospital, London). Intern. J. Appl. Radiation and Isotopes 1, 85-93(1956) July.

The advantages of using I^{132} instead of I^{131} in clinical applications are discussed. Its use in diagnostic tests can result in a reduction of the radiation dosage to the patient by at least a factor of 15 and in some cases, of the order of 100. It is compared with I^{131} in thyroid tests, in plasma-volume determinations, in haemodynamic studies, and in the localization of placental sites and its use, with I^{131}, in double tracer studies is considered. The production of Te^{132}, which is the mother substance of I^{132}, from the fission products of uranium is described, and a method is given for the separation of iodine from tellurium, using only simple, normally available apparatus. (auth)

11022

A SIMPLIFIED METHOD FOR QUANTITATION OF AUTORADIOGRAPHY. F. J. Domingues, A. Sarko, and R. R. Baldwin (General Foods Corp., Hoboken, N. J.). Intern. J. Appl. Radiation and Isotopes 1, 94-101(1956) July.

The method for quantitation of autoradiography is based on preparation of radioactive standards which, in conjunction with histological sections of unknown activity, are exposed to photographic film. The method is accurate to within 5%. The amount of activity in the experimental section is derived by comparison of the optical density of the film to that of the standard. Standard isotope concentrations are made up in appropriate embedding material and poured into uniform cavities of known volume and geometry. Assuming exponential absorption one can calculate the amount of radiation emanating from the surface of the activity plug at any desired time. The histological section is of a known thickness and experimentally determined density. The amount of absorption taking place within the specimen is calculated. After an optimum time of exposure, the standard and histological section are removed and the film developed under controlled processing conditions. The optical densities of standards and unknown are then read with a densitometer which has a fixed geometric scan. The areas under the density curve are plotted against disintegrations striking the film from the standard activity plugs. The value for the disintegrations in the unknown is read directly from such a curve. An example is given of the application of the technique in determining the amount of S^{35} absorbed in experimental plant material. (auth)

11023

ADRENAL AND HYPOPHYSEAL INFLUENCES UPON THE UPTAKE OF RADIOACTIVE GOLD (Au^{198}) BY THE RETICULO-ENDOTHELIAL SYSTEM. Sherwood M. Reichard, Abraham Edelmann, and Albert S. Gordon (New York Univ. and Brookhaven National Lab., Upton, N. Y.). Endocrinology 59, 55-68(1956) July.

11024

RADIOIODINE NOT DISCHARGEABLE WITH PERCHLORATE IN THE THYROIDS OF PROPYLTHIOURACIL TREATED RATS. N. S. Halmi and R. G. Stuelke (State Univ. of Iowa, Iowa City). Endocrinology 59, 134-6(1956) July.

11025

ENDOCRINE INFLUENCES UPON THE UPTAKE OF COLLOIDAL THORIUM BY THE RETICULOENDOTHELIAL SYSTEM. Sherwood M. Reichard, Abraham Edelmann, and Albert S. Gordon (New York Univ. and Brookhaven National Lab., Upton, N. Y.). J. Lab. Clin. Med. 48, 431-41(1956) Sept.

11026

RADIOACTIVE (I^{131}-TAGGED) ROSE-BENGAL LIVER FUNCTION TEST. Charles H. Brown and Otto Glasser (Cleveland Clinic Foundation and Frank E. Bunts Educational Inst., Cleveland, Ohio). J. Lab. Clin. Med. 48, 454-62(1956) Sept.

11027

A PLASTIC COIL SIMPLIFYING RADIOACTIVE LIQUID PHASE COUNTING. Solomon N. Albert, Wm. A. Spencer,

Murray Finkelstein, Jo Shibuya, Seymour Alpert, and Charles S. Coakley (District of Columbia General Hospital and George Washington Univ. Hosp., Washington, D. C.). J. Lab. Clin. Med. 48, 471-5(1956) Sept.

A technique is described for blood volume determinations which employs a plastic coil fixed in a well-type scintillation counter through which sample radioactive fluids are drawn or passed following the intravenous administration of radioisotopes. The coil method has proved efficient in both in vitro and patient serial blood volume studies, and with arteriovenous shunt through the coil, in continuous blood volume estimation and hemodynamic studies. (C.H.)

11028

RADIOAKTIVER PHOSPHOR IN DER PFLANZENERNÄHRUNG. (RADIOACTIVE PHOSPHORUS IN PLANT NUTRITION). S. Gericke. Essen, Tellus-Verlag, 1955. 63p. (In German)

11029

THE INFLUENCE OF CHELATION ON RADIOMANGANESE EXCRETION IN MAN AND MOUSE. Laurence S. Maynard and Sidney Fink (Brookhaven National Lab., Upton N. Y. and Montefiore Hospital, New York). J. Clin. Invest. 35, 831-6 (1956) Aug.

11030

STATISTICAL APPRAISAL OF THE USE OF RADIOACTIVE IODINATED HUMAN SERUM ALBUMIN FOR THE DETECTION OF LIVER METASTASES. Samuel H. Madell, Morton M. Kligerman, Edith H. Quimby, and John W. Fertig (Columbia Univ. Coll. of Physicians and Surgeons and Presbyterian Hospital, New York). Radiology 67, 210-17(1956) Aug.

We have explored the feasibility of determining the presence or absence of liver metastases by scintillation counter measurement of the differential concentration of I^{131}HSA, using statistical methods. Direct inspection of the liver and abdomen was carried out in every patient by laparotomy. There was no significant difference between the number of abnormal readings to a group with liver metastases and a group with intra-abdominal cancer without liver metastases. However, in the presence of intra-abdominal cancer, primary or metastatic, a significantly large number of abnormal readings was obtained over the abdomen, although the degree of significance is not great. An in vitro experiment showed that the experimental set-up was adequate to detect localized concentrations of radioactive material, if such concentration was as much as three times the normal for the point. For small concentrations, the counter gave adequately high readings only if it was centered directly over the deposit. Even then, if more than 6 cm of tissue intervene, detection becomes uncertain. (auth)

11031

ISOTOPES IN THE STUDY OF THE PATHOGENESIS OF METABOLIC DISEASES. D. E. Grodzenskii. Soviet J. Atomic Energy, No. 1, 93-100(1956).

A survey is made of the use of radioisotopes in the study of the pathogenesis of metabolic diseases. (B. J. H.)

11032

SIMPLIFIED LIQUID EMULSION RADIOAUTOGRAPHY. David L. Joftes and Shields Warren (New England Deaconess Hospital, Boston). J. Biol. Phot. Assoc. 23, 145-50(1955) Nov.

A liquid emulsion radioautography method is described: simple and suitable for routine or special work. Method depends upon dipping stained histological slides (with an acrylic plastic film supplanting cover glass) into melted photographic emulsion. (auth)

11033

CLEARANCE OF RADIOACTIVE IODINE FROM THE LOWER EXTREMITIES OF PATIENTS WITH MYOCARDIAL INFARCTION. Franz K. Bauer, Frederick R. Mugler, Vernon W. Lieberman, and John P. Westergart (Wadsworth General Hospital, Los Angeles and Univ. of California Medical Center, Los Angeles). Am. J. Med. Sci. 232, 44-9(1956) July.

The clearance of tracer amounts of radioactive iodine from the thigh, injected by Hypospray, was measured in patients with recent myocardial infarction throughout convalescence. Greatly prolonged clearance times were found in the first few weeks after infarction. The clearance became normal in the 6th week in the majority of patients. In a number of patients, the clearance remained prolonged in the sitting position once it had returned to normal in the supine position. These findings suggest a diminution of the peripheral capillary bed, possibly due to diminished cardiac output. (auth)

11034

ADVANTAGES GIVEN BY P^{33}-OR AGED P^{32}-IN AUTORADIOGRAPHY. Jane Mayr (Univ. of Cambridge, England). Experientia 12, 298-9(1956) Aug. (In English)

11035

EXPERIMENTS WITH LIQUID EMULSION IN HYSTORADIOAUTOGRAPHY. N. D. Gracheva, L. N. Zhinkin, and E. I. Shcherban (Central Research Roentgen-Radiological Inst.). Med. Radiol. No. 2, 87-93(1956) Mar.-Apr. (In Russian)

11036

ABSORPTION FROM DIGESTIVE TRACK AND UTILIZATION OF PHOSPHORUS DURING EXPERIMENTALLY INDUCED HEPATITIS. K. S. Zamychkina, E. A. Rudik-Gnutova, D. E. Grodzenskiĭ, and L. I. Belorybkina. (Inst. of Normal and Pathological Physiology). Med. Radiol. No. 3, 63-71(1956) May-June. (In Russian)

11037

FERMENTATION OF C^{14}-LABELED GLUCOSE BY CLOSTRIDIUM PERFRINGENS. L. M. Paege, Martin Gibbs, and R. C. Bard (Frankford Arsenal, Philadelphia; Brookhaven National Lab., Upton, N. Y.; and Indiana Univ., Bloomington). J. Bacteriol. 72, 65-7(1956) July.

The fermentative metabolism of Clostridium perfringens has been studied using glucose specifically labeled with carbon 14. Evidence is presented which indicates that although the Embden-Myerhof-Parnas pathway is in part operative in this organism, a different terminal pathway exists, probably involving triose metabolism. (auth)

11038

LABELING CROWN GALL BACTERIA WITH P^{32} FOR RADIOAUTOGRAPHY. Tom Stonier (Brookhaven National Lab., Upton, N. Y.). J. Bacteriol. 72, 259-68(1956) Aug.

Refer also to abstract 11380.

CHEMISTRY

11039 ISC-668

Ames Lab., Ames, Iowa.

IODATO-SILVER COMPLEXING EQUILIBRIA. James J. Renier and Don S. Martin. Aug. 28, 1955. 46p. Contract W-7405-eng-82. $0.35(OTS).

Solubilities of $AgIO_3$ in aqueous solutions containing various concentrations of $LiIO_3$ have been measured for 25.0, 35.0 and 50.0°C. by means of an improved radioassay technique for Ag activity. They have also been measured for the same temperatures in aqueous solutions containing various proportions of $LiIO_3$ and $LiClO_4$. In the latter experiments, the ionic strengths of all equilibrium solutions were fixed at a value of 1.00M. The refined radiotracer method has been described in detail and the advantages which it possesses over existing techniques for radiosilver

assay have been discussed. A series of experiments performed to test the procedure for sampling of the equilibrated mixtures have also been presented. The data have been interpreted in terms of equilibria which involve the species Ag^+, $AgIO_3$(s), $AgIO_3$ (aq.), and $Ag(IO_3)_2^-$ and equilibrium constants for reactions involving these species have been calculated. From the solubilities and their temperature coefficients thermodynamic quantities for the iodato complexes have also been computed. The entropy changes observed for the reactions to form $AgIO_3$ (aq.) and $Ag(IO_3)_2^-$ have been compared with those calculated from a semi-empirical formulation. (auth)

11040 ISC-686

Ames Lab., Ames, Iowa.

TEMPERATURE COEFFICIENT OF ELECTRICAL CONDUCTIVITY IN THE SYSTEM POTASSIUM CHLORIDE–ZINC CHLORIDE. R. A. Fleming and F. R. Duke. Dec. 1955. 41p. Contract W-7405-eng-82. $0.30(OTS).

The phase diagram of the system $KCl-ZnCl_2$ has been constructed. Values of specific conductivity and density have been determined at eight temperatures in the range 475 to 650°C. for a series of compositions covering the concentration range. From these data, equivalent conductivities were calculated. The temperature coefficient of conductivity as expressed by the activation energy of ionic migration was calculated at four temperatures for each mixture. The phase diagram indicates compound formation in the solid state with the compound $2KCl-ZnCl_2$ melting at about 450°C. Density isotherms are "S" shaped, deviating from additivity in a positive direction at low concentrations of KCl and exhibiting a slight negative deviation at high concentrations of KCl. Isotherms of equivalent conductivity are approximately additive in the range $0.00 < X_{KCl} < 0.30$ but then begin to deviate negatively, reaching a maximum negative deviation near $X_{KCl} = 0.71$. The activation energy at constant temperature falls rapidly from that of zinc(II) chloride as the concentration of KCl increases until X_{KCl} has reached 0.30. The activation energy then slowly falls to the limiting value for pure KCl in an approximately linear manner. The deviations noted in the isotherms of equivalent conductivity agree with the predictions of Bloom and Heymann. A knowledge of the transport numbers of the individual ions is necessary for meaningful interpretation of the isotherms of activation energy. (auth)

11041 NAVORD-2048

Naval Ordnance Test Station, Inyokern (China Lake), Calif.

DEPOSITION OF CADMIUM BY CHEMICAL REDUCTION. Dwight E. Couch and Harold Smallen. Aug. 17, 1953. 12p. Project 701. (NOTS-740).

Chromous chloride and sodium formate were found to be effective agents for reducing Cd^{2+} to the free metal. The reduced metal analyzed 97 to 98% Cd. Reductions were carried out in three types of baths: aqueous solutions, fused-salt solutions, and organic solutions. (auth)

11042 UCRL-4707

California. Univ., Livermore. Radiation Lab.

SOLID ARSENIC HYDRIDES. W. L. Jolly, L. B. Anderson, and R. L. Beltrami. June 7, 1956. 27p. Contract W-7405-eng-48. $0.25(OTS).

Various methods for preparing solid arsenic hydrides have been evaluated as to yield and product composition. The highest hydrogen content observed for a solid hydride corresponds to the empirical formula $AsH_{0.52}$. A method has been developed for preparing an unstable, volatile arsenic hydride (probably biarsine, As_2H_4) from arsine by the use of a silent electrical discharge. (auth)

11043 AEC-tr-2631

IF_5, IOF_3 AND THE POSSIBILITY OF FORMING LOWER IODINE FLUORIDES. Otto Ruff and Alfred Braida. Translated by I. A. Warheit from Z. anorg. u allgem. Chem. 220, 43-8(1934). 6p.

The physical constants of IF_5 were determined. IOF_3 was produced and some of its properties investigated. It could not be proved that a lower IF existed. (W.L.H.)

11044

THE THERMODYNAMIC PROPERTIES OF DILUTE ALKALI METAL AMALGAMS. Harold L. Friedman and Kenneth Schug (Univ. of Southern California, Los Angeles). J. Am. Chem. Soc. 78, 3881-8(1956) Aug. 20.

The thermodynamic properties of ternary amalgams containing Na with K, Rb, Cs or Sr have been investigated by an equilibrium method. The results, together with independent data for Na amalgam, yield properties of the binary amalgams of K, Rb, Cs and Sr. When combined with data from other sources, these provide information on the formation of the alkali metal amalgams from the elements and the deviations from Raoult's law of these solutions. For the process $M(Hg, Hyp.\ 1\ molal) = M^+(gas) + e^-(gas)$, ΔH decreases from Li to Cs, but ΔS increases strongly, becoming +30 e.u. for Cs. This and several other amalgam properties are consistent with the hypothesis that the alkali metals are ionized in the amalgams and that only the electron tends to enter the mercury phase from the gas phase. Then the positive ions tend to escape the amalgam, the more so the larger the ion, but this tendency is overcome by the forces leading to electroneutrality of the phase. The detailed form of the activity coefficients in the amalgams is consistent with a Brönsted specific ion interaction between the electrons and the positive ions in the amalgam in a way similar to that first suggested by C. Wagner. The temperature coefficients of the activity coefficients reflect the large entropy effects in solvation. (auth)

11045

HYDROLYTIC BEHAVIOR OF METAL IONS. VI. ULTRACENTRIFUGATION OF ZIRCONIUM(IV) AND HAFNIUM (IV); EFFECT OF ACIDITY ON THE DEGREE OF POLYMERIZATION. James S. Johnson and Kurt A. Kraus (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 78, 3937-43(1956) Aug. 20.

Polymerization of Zr and Hf (ca. 0.05M) has been investigated by equilibrium ultracentrifugation. Hf(IV) at this concentration is probably polymerized in 5M HCl. There is definite polymerization in 3M HCl. In the range 0.5–2M HCl, Hf(IV) is probably either a trimer or tetramer and the degree of polymerization is relatively independent of Hf(IV) and HCl concentrations. At acidities 0.2M and less, Hf(IV) is more highly polymerized and polydisperse. Polymerization of Zr(IV) is similar. The principal difference is that Zr(IV) is more highly aggregated than Hf(IV) at the lower acidities. Centrifugation of solutions containing varying concentrations of Zr(IV) and of supporting electrolyte in 1M HCl indicate that the polymers, like those of Hf, are trimeric or tetrameric at this acidity and carry charges of ca. plus one per monomer unit. The same degree of polymerization was found for Zr(IV) in 1M $HClO_4$. Decrease of temperature from ca. 25° to ca. 5° markedly lowers the degree of polymerization in 0.08M HCl, in contrast to the small effect observed in 1M HCl. Aging of $ZrOCl_2$ solutions, or heating, increased the degree of polymerization significantly but did not produce very large polymers. (auth)

11046

KINETICS OF 1,10-PHENANTHROLINE CHELATION. I. MONO-(1,10-PHENANTHROLINE)–NICKEL(II). D. W. Margerum, R. I. Bystroff, and Charles V. Banks (Iowa State Coll., Ames). J. Am. Chem. Soc. 78, 4211-17(1956) Sept. 5.

The effect of hydrogen ion concentration on the kinetics of formation and dissociation of the mono-(1,10-phenanthroline)–nickel(II) complex is examined. Two mechanisms are proposed as possible reaction paths. One mechanism is the acid-catalyzed reaction of an unstable intermediate formed between the ligand and Ni^{2+}; the other mechanism is the reaction of the 1,10-phenanthrolium ion with Ni^{2+} to form an intermediate. Both mechanisms fit the general expression $k_{lf} = ([H^+] + 0.0043)/(2.62\ [H^+] + 0.258)\ 10^5$ 1/mol/sec. The equilibrium constants of the mono-, bis- and tris-(1,10-phenanthroline)–nickel(II) complexes are $K_1 = 2.5 \times 10^{-9}$, $K_2 = 8 \times 10^{-9}$, $K_3 = 2.8 \times 10^{-8}$, respectively. (auth)

11047

THE HEAT OF FORMATION OF Cs(Hg) AND OF Ca^+(aq) AT 25°. Harold L. Friedman and Manfred Kahlweit (Univ. of Southern California, Los Angeles). J. Am. Chem. Soc. 78, 4243-5(1956) Sept. 5.

The following standard heats of reaction have been determined calorimetrically: $Cs(c) \rightarrow Cs(Hg)$, $\Delta H^\circ = -31.2 \pm 0.3$ kcal/mole; $Cs(c) + H^+(aq) \rightarrow Cs^+(aq) + \frac{1}{2}H_2(g)$, $\Delta H^\circ = -62.6 \pm 0.4$ kcal/mole. These results are compared critically with the results of earlier determinations. Combined with accepted entropy data they yield for $Cs^+(aq)$, $\Delta F^\circ = -70.8$ kcal/mole, and for the Cs/Cs^+ couple, $E^\circ_{ox} - 3.08$ volts. (auth)

11048

PRESSURE-TEMPERATURE CURVES IN SOME SYSTEMS CONTAINING WATER AND A SALT. George W. Morey and W. T. Chen (Carnegie Institution of Washington, D. C.). J. Am. Chem. Soc. 78, 4249-52(1956) Sept. 5.

A novel method for the determination of vapor pressures of saturated solutions has been applied to binary systems containing water and the salts LiF, NaF, KF, NaCl, KCl, RbCl, CsCl, $PbCl_2$, Li_2SO_4, Na_2SO_4, K_2SO_4, Tl_2SO_4, Na_2CO_3, K_2CO_3, $Na_2O \cdot 4B_2O_3$, $Na_4P_2O_7$, and $K_4P_2O_7$ at some or all of the temperatures 374, 400, 500, 600, and 700°. (auth)

11049

LIQUID VISCOSITIES AT ELEVATED TEMPERATURES AND PRESSURES: VISCOSITY OF BENZENE FROM 90° TO ITS CRITICAL TEMPERATURE. John R. Heiks and Edward Orban (Mound Lab., Miamisburg, Ohio). J. Phys. Chem. 60, 1025-7(1956) Aug.

A viscometer suitable for measurement of viscosities of fluids at elevated temperatures and pressures is described. The time of fall of a radioactive plummet is determined by means of two sets of coincident ionization chambers an electronic timer. The viscosity of benzene was measured from 90° to its critical temperature. From 90° to about 180° the variation of the logarithm of the viscosity of benzene with the reciprocal of the temperature is a straight line, but above this temperature the rate of change increases with increasing temperature. (auth)

11050

ELECTRICAL CONDUCTANCE AND DENSITY OF PURE MOLTEN ALKALI HALIDES. I. S. Yaffe and E. R. Van Artsdalen (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 60, 1125-31(1956) Aug.

Measurements of specific conductance and of density as functions of temperature have been made on all pure molten alkali chlorides, bromides and iodides. From these data, the equivalent conductance and the molar volume of each salt have been calculated at temperatures up to 200° above the melting point. In general, the equivalent conductance differs among these salts in a regular manner and may be correlated with fundamental properties of the constituent ions. It is necessary, however, to make comparisons at corresponding temperatures. Conductance has been treated as a rate process and the heat and the entropy of activation were calculated from the experimental results. The heat of activation varies with temperature, with the sign of the temperature coefficient depending upon the cation. The calculated entropies of activation were found to be negative, of reasonable magnitude and nearly independent of temperature. The melting points of various alkali halides were redetermined by a method which takes advantage of the rapid change of resistance at the solidification point. (auth)

11051

THE SALTING IN OF SUBSTITUTED BENZENES BY LARGE ION SALTS. R. L. Bergen, Jr. and F. A. Long (Cornell Univ., Ithaca, N. Y.). J. Phys. Chem. 60, 1131-5 (1956) Aug.

The effects of salts on the activity coefficients of a series of acidic and basic derivatives of benzene in aqueous solutions have been measured at 25° by either solubility or distribution procedures. Salts of such large ions as tetraethylammonium and toluenesulfonate lead to salting in for all cases. There is a pronounced dependence of the extent of salting in by the large ion salts on the acidic and basic character of the non-electrolytes. The direction of the dependence is opposite to that observed for very small cations. Possible explanations are discussed. (auth)

11052

SZILARD-CHALMERS REACTION IN SOME RHENIUM COMPOUNDS. George K. Schweitzer and Dale L. Wilhelm (Univ. of Tennessee, Knoxville). J. Inorg. and Nuclear Chem. 3, 1-8(1956) Aug.

This work was initiated in an attempt to contribute information on the behaviour of Re compounds when undergoing the Szilard-Chalmers reaction. Several compounds of Re were prepared, and from these experiments some preparations have been more carefully elaborated than had previously been done. An interpretation of perrhenate irradiations was made on the basis of a theory of rapid recombination of recoil fragments within a solvent molecule "cage." While an indication of dependence of retention upon degree of covalency of the ligand bonds in Re complex compounds was found, the dependence was not conclusively attributed to this property alone. The best method of producing high-specific-activity radioactive perrhenate solutions found in this work was by irradiation of an aqueous solution of K_2ReCl_6. (auth)

11053

THE PROTON DISSOCIATION AND HYDROLYSIS OF TRINITRATONITROSYLRUTHENIUM IN AQUEOUS SOLUTIONS. I. L. Jenkins and A. G. Wain (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 3, 28-37(1956) Aug.

Electrical conductivity measurements on solutions of the trinitratonitrosylruthenium complex in water indicate that it is an acid for which the first dissociation constant has a value of 0.014 mole/liter. The partition coefficient of the complex between solutions in water and in tri-n-butyl phosphate (TBP) has been calculated from its observed distribution between these solvents and the degree of dissociation of the complex in aqueous solutions. The hydrolysis of the complex in HNO_3 solutions has been shown to occur initially by a first-order rate process with a rate constant k = 0.046/min at 25°C. (auth)

11054

METAL–WATER REACTIONS. III. KINETICS OF THE REACTION BETWEEN THORIUM AND WATER VAPOR. Bruce E. Deal and Harry J. Svec (Iowa State Coll., Ames). J. Electrochem. Soc. 103, 421-5(1956) Aug.

An examination of the reaction between Th metal and H_2O vapor has been made between 200 and 600°C and at water-vapor pressures of 25 to 100 mm Hg. Analyses of the

products indicate that ThO_2 and H_2 are the main species formed during the reaction with formation of ThH_2 as a possible side reaction product. Two methods, one gravimetric and the other manometric, were used to determine rates of reaction. During these rate studies, the variables time, temperature, and pressure were examined. Reaction data were found to obey the logarithmic rate law $w = k \log(1 + 0.45t)$. The activation energy was found to have an average value of 6.44 ± 0.75 kcal/mole. From marker experiments it is postulated that inward diffusion of H_2O molecules or a related species is the rate-determining step of the reaction. Other experiments showed that H_2 diffused into the metal in varying amounts depending on temperature and water-vapor pressure. This H_2 was evolved when the samples were heated under high vacuum to 1200°C. (auth)

11055

THERMODYNAMIC DATA ON CONCENTRATED SULPHURIC ACID SOLUTIONS. E. Glueckauf and G. P. Kitt (Atomic Energy Research Establishment, Harwell, Berks, England). Trans. Faraday Soc. 52, 1074-9(1956) Aug.

The vapor pressures at 25° C of sulfuric acid solutions of 20 to 65 moles H_2SO_4 per 1000 g of water have been measured by an isopiestic method. These free energy data, together with heat contents and capacities from the literature, permit a calculation of the partial thermodynamic quantities, which have been tabulated for solutions up to 76 molal. (auth)

ANALYTICAL PROCEDURES

11056 HW-32210(Rev.)

Hanford Atomic Products Operation, Richland, Wash.

RADIUM DETERMINATIONS IN SOIL, VEGETATION AND WATER BY RADON COUNTING. H. G. Rieck and R. W. Perkins. May 7, 1956. 17p. Contract W-31-109-Eng-52. $0.20(OTS).

A procedure was developed which results in detection limits for radium of 2.3×10^{-14} gram/gram in a 5 gram soil sample, 2.3×10^{-15} gram/gram in a 50 gram vegetation sample, and 1.7×10^{-16} gram/gram for a 500 ml water sample at the 95% confidence level. Revised analytical procedures for radium analysis were used in sample preparations and the radon daughter resulting from radium decay was determined in an ionization chamber using the vibrating reed electrometer as a detection instrument. Radiochemical yields of 100% for water, 73% for vegetation, and 72% for soil samples were obtained as determined on radium spiked samples. (auth)

11057 MCC-1023-TR-217

Pennsylvania. Univ., Philadelphia.

DETERMINATION OF CARBON AND HYDROGEN IN ORGANIC COMPOUNDS CONTAINING BORON. Final Report. W. J. Schuele and W. M. McNabb. July 1956. 34p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

Carbon and hydrogen determinations were made on standard samples and several boron containing organic compounds. A weighed sample was heated in an atmosphere of oxygen, under controlled pressure, to yield carbon dioxide from the carbon and water from the hydrogen. These combustion products were determined gravimetrically by measuring the change in weight of the proper absorbing agents. The equipment available was a micro, semi-micro carbon and hydrogen train modified by using a motor driven sample burner. Some modifications of the procedure were necessary, varying with the composition and volatility of the compounds analyzed. The compounds analyzed for carbon and hydrogen included sugar, acetanilide, and benzoic acid as standards and sodium tetraphenyl boron, tricyclohexylborate, 2,4, 6-triamylboronic acid, p-tolylboronic acid, unknowns labeled Z164, Z208, and Z209. (auth)

11058 NAA-SR-1395

North American Aviation, Inc., Downey, Calif.

POLAROGRAPHIC DETERMINATION OF BIPHENYL IN BINARY MIXTURES WITH THE THREE TERPHENYLS AND WITH META-POLYPHENYL TETRAHYDROFURAN AS SOLVENT. Louis Silverman and Wanda Bradshaw. Dec. 1, 1955. 30p. Contract AT-11-1-GEN-8. $4.80(ph OTS); $2.70(mf OTS).

The polarographic determination of biphenyl alone, of biphenyl in binary mixtures with the isomeric terphenyls, and of biphenyl in mixture with a higher meta-polyphenyl was studied. A number of solvents were investigated for suitability and the half-wave potentials and diffusion currents of biphenyl and the terphenyls in these media are reported. A tetrahydrofuran–water mix produced the highest diffusion current for biphenyl at the dropping mercury electrode. There exists a sufficiently large difference of reduction potential between that of biphenyl and of either para- or meta-terphenyl in this solvent so that a rapid polarographic determination of biphenyl in the presence of these terphenyls can be made. The smallest concentration of biphenyl which can be detected is 0.001 mg/ml (0.005 mg). Biphenyl can be quantitatively determined in binary mixture with the para- and meta-terphenyls; conversely, meta- or para-terphenyl can be determined (in limited ratio) in the presence of biphenyl. The diffusion current of biphenyl in tetrahydrofuran–water mix is much greater than that of an equal weight of ortho-terphenyl. Consequently, biphenyl can be determined (in limited ratio) in the presence of ortho-terphenyl. However, ortho-terphenyl cannot be determined in the presence of biphenyl. (auth)

11059 ORNL-2153

Oak Ridge National Lab., Tenn.

DETERMINATION OF COPPER IN SOLUTIONS OF URANYL SULFATE BY INTERNAL ELECTROLYSIS. Oscar Menis, D. L. Manning, and R. G. Ball. Sept. 27, 1956. 14p. Contract W-7405-eng-26. $0.20(OTS).

A method is described for the determination of copper in solutions of uranyl sulfate by internal electrolysis. An electrolytic cell, composed of a platinum cathode and a cadmium anode which are separated by an alundum thimble, is used to deposit the copper from test solutions. The method is applicable to solutions that contain from 1 to 40 mg of copper. The precision of the method is related, however, to the quantity of copper that is deposited. The precision of the electrogravimetric method was compared with that of the diethyldithiocarbamate colorimetric procedure and no significant variation between the two methods was found to exist. The advantage of the electrogravimetric method is that copper can be determined by weighing after electrodeposition, thus combining the separation and determination of copper in the analysis of solutions of uranyl sulfate. (auth)

11060 USNRDL-TR-103

Naval Radiological Defense Lab., San Francisco.

VARIATIONS IN PAPER ELECTROPHORETIC PATTERNS OF DOG SERA AND PLASMAS PREPARED BY DIFFERENT TECHNIQUES. W. H. Goldwater and C. Entenman. July 25, 1956. 17p. Project NM-006-015.

11061

SPECTROPHOTOMETRIC STUDY OF THE THORIUM-MORIN MIXED-COLOR SYSTEM. Mary H. Fletcher and Robert G. Milkey (U. S. Geological Survey, Washington, D. C.). Anal. Chem. 28, 1402-7(1956) Sept.

A spectrophotometric study was made of the thorium-

morin reaction to evaluate the suitability of morin as a reagent for the determination of trace amounts of Th. At pH 2, the equilibrium constant for the reaction is 1×10^6, and a single complex having a thorium–morin ratio of 1 to 2 is formed. The complex shows maximum absorbance at a wave length of 410 mμ, and its absorbance obeys Beer's law. The absorbance readings are highly reproducible, and the sensitivity is relatively high, an absorbance difference of 0.001 being equivalent to 0.007 γ of ThO_2 per sq. cm. The effects of acid, alcohol, and morin concentration, time, temperature, and age of the morin reagent as well as the behavior of morin with Zr^{+4}, Fe^{+3}, Al^{+3}, Yb^{+3}, Y^{+3}, U^{+6}, Pr^{+3}, Pb^{+2}, La^{+3}, and Ca^{+2} ions are discussed. A method is presented for the determination of Th in pure solutions. Appropriate separations for the isolation of Th may extend the usefulness of the method and permit the determination of trace amounts of Th in complex materials. (auth)

11062

DETERMINATION OF IRON IN TITANIUM SPONGE, ALLOYS, AND ORES. AUTOMATIC DERIVATIVE SPECTROPHOTOMETRIC TITRATION WITH ELECTROLYTICALLY GENERATED TITANOUS ION. Howard V. Malmstadt and Charles B. Roberts (Univ. of Illinois, Urbana). Anal. Chem. 28, 1412-16(1956) Sept.

Iron in Ti sponge, alloys, and ores can be determined rapidly, precisely, and accurately by a new and completely automatic titration procedure. The sample is dissolved in either H_2SO_4 or a HBF_4–H_2SO_4 mixture, and the Fe is oxidized to the Fe^{+3}, with leuco methylene blue added as an indicator. The Fe^{+3} is automatically titrated in the derivative spectrophotometric titrator with electrolytically generated Ti^{+3} supplied by the Ti in the samples. A generator electrode is described which provides 100% efficient generation of Ti^{+3} in the acid solutions, with no electrode care after it is once prepared. The method is useful over a wide concentration range of Fe–0.01 to 20% or more. The precision is within 0.1% relative for Fe concentrations greater than 3%, and the average absolute error is about 0.003%. It is possible to run the complete determination in about 35 minutes, most of which is consumed in dissolving the sample. The method has excellent possibilities for rapid automatic titration of other materials which contain constituents readily reduced by Ti^{+3}. (auth)

11063

FLAME PHOTOMETRIC DETERMINATION OF LITHIUM, RUBIDIUM, AND CESIUM IN SILICATE ROCKS. E. L. Horstman (Univ. of Minnesota, Minneapolis). Anal. Chem. 28, 1417-18(1956) Sept.

For the flame photometric determination of the trace alkali elements, Li, Rb, and Cs, in silicate rocks, the alkali metals and Mg are separated from the other rock constituents by H_2SO_4 and HF decomposition followed by precipitation of the NH_3 group with solid $CaCO_3$. Ca is removed from the filtrate by precipitation of the SO_4 in 50% C_2H_5OH. The alcohol is removed from the final filtrate by evaporation and the salts are dissolved in H_2O. Flame interference from Na and K is compensated by use of appropriate standard solutions. The method shows a precision and accuracy within 10% in the range from 10 to 200 p.p.m. of the alkali metal and is sensitive to 5 p.p.m. Li, 10 p.p.m Rb, and 5 p.p.m. of Cs. (auth)

11064

STABLE CARBON ISOTOPE ANALYSIS BY OPTICAL SPECTROSCOPY. R. E. Ferguson and H. P. Broida (National Bureau of Standards, Washington, D. C.). Anal. Chem. 28, 1436-8(1956) Sept.

The use of C_2 radiation from an acetylene flame for the measurement of relative concentrations of the C isotopes, C^{12} and C^{13}, has been investigated. C^{13}-enriched samples of acetylene were burned in pre-mixed flames with air, and relative intensities of the mixed flames with air, and relative intensities of the Swan bands due to the isotopic C_2 radicals were measured photoelectrically. A representative calibration curve of the intensity ratio $C^{12}C^{13}/C^{12}C^{12}$ vs. C^{13} abundance in the fuel is presented and discussed. (auth)

11065

SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM QUANTITIES OF DISODIUM DIHYDROGEN ETHYLENEDIAMINE TETRAACETATE. Oscar Menis, H. P. House, and I. B. Rubin (Oak Ridge National Lab., Tenn.). Anal. Chem. 28, 1439-41(1956) Sept.

A rapid spectrophotometric method for the determination of microgram quantities of disodium ethylenediamine tetraacetate (EDTA) is based on the absorbance of the complex formed by the reaction of EDTA with an excess of cupric ion. The copper-EDTA complex is developed in a NaH_2PO_4 buffer of pH 11 Absorbance is measured against a $CuSO_4$-buffer reference solution at 250 mμ. The effects of several variables were studied and optimum operating conditions established. Nickel, cobalt, and chromate interfere; cations that form weaker complexes with EDTA than Cu do not interfere. The relative standard deviation for samples containing 125 to 500 γ of EDTA was 8%; for 500 to 1500 γ, 2%. (auth)

11066

PYROHYDROLYTIC SEPARATION AND SPECTROPHOTOMETRIC TITRATION OF FLUORIDES IN RADIOACTIVE SAMPLES. J. E. Lee, Jr., J. H. Edgerton, and M. T. Kelley (Oak Ridge National Lab., Tenn.). Anal. Chem. 28, 1441-3 (1956) Sept.

Apparatus is described which is suitable for the pyrohydrolytic determination of fluoride in radioactive liquids or solids. Fluoride in the radioactive distillate from the pyrohydrolysis is determined by a remotely controlled titration in an apparatus of special design. The apparatus was evaluated by determining the fluoride content of solid UF_4, a mixture of solid fluoride salts, and a solution of fluoride salts. The relative standard deviation of the data for 2.5 to 15 mg. of fluoride was 3% for UF_4 samples. (auth)

11067

PHOTOMETRIC TITRATION OF SMALL AMOUNTS OF BARIUM WITH (ETHYLENEDINITRILO) TETRAACETIC ACID. Allen I. Cohen and Louis Gordon (Syracuse Univ., N. Y.). Anal. Chem. 28, 1445-7(1956) Sept.

A method for the photometric titration of small quantities of Ba with (ethylenedinitrilo)tetraacetic acid uses as indicator Phthalein Purpur, a phenolphthalein derivative having iminodiacetate functional groups. This forms a complex with Ba which shows an absorbance maximum at 570 mμ. From 0.05 to 12 mg. of Ba can be determined by titration with 0.01 or 0.002M (ethylenedinitrilo)tetraacetic acid. (auth)

11068

DETERMINATION OF SMALL QUANTITIES OF HYDROGEN IN THE INERT GASES. Louis Silverman and Wanda Bradshaw (Atomics International, Canoga Park, Calif.). Anal. Chim. Acta 15, 31-42(1956) July.

A sensitive reagent, methylene blue–$PdCl_2$ is applicable to the determination of smaller amounts of H_2 in inert gases. Using this reagent, and a continuous gas-flow type of analysis, the range of the method is 0.1 to 10 ppm H_2 with a standard deviation of ±0.1 to ±0.2 ppm. The amount of sample gas needed is 5 to 20 liters. It must be oxygen-free before analysis for H_2. This method of H_2 analysis can be used for inert gas systems consisting of He, A or N_2. (auth)

11069

A D.C. ARC METHOD FOR THE SPECTROGRAPHIC DETERMINATION OF HAFNIUM IN ZIRCONIUM. R. K. Dhumwad

and M. D. Karkhanavala (Atomic Energy Establishment, Bombay, India). Anal. Chim. Acta 15, 87-90(1956) July.

A spectrographic method is presented for the quantitative determination of Hf in Zr in the range 0.2 to 5% HfO_2. The sample in the form of a fine powder is burnt in a d-c arc at 15 amp, 220 v, and the spectrum photographed with a large quartz spectrograph. The hafnia concentration is determined from the ratio of the intensities of the spectral lines HfII 2861.696 Å and ZrII 2856.065 A. A standard deviation of ± 6% has been obtained by this method for samples essentially free from other impurities, especially Fe, Al, Mg, and Na. (auth)

11070

ANALYTICAL APPLICATIONS OF THE CHEMICAL ACTION OF LIGHT. III. NEW VOLUMETRIC DETERMINATION OF URANIUM(VI) THROUGH PHOTOCHEMICAL REDUCTION BY LACTIC ACID. G. Gopala Rao, V. Panduranga Rao, and M. V. Rama Rao (Andhra Univ., Waltair, India). Anal. Chim. Acta 15, 97-101(1956) Aug.

A new volumetric method for the determination of U^{6+} has been developed. The method consists in exposing the U^{6+} salt in 1.0 to 2.0N H_2SO_4 solution with an excess of lactic acid to sunlight or to the light of a Philips Repro Lamp for one hour. The U^{4+} salt formed by reduction is estimated by titration with a standard solution of sodium vanadate with N-phenyl anthranilic acid as redox indicator. One important advantage of the new method is that the U^{6+} salt is not reduced to the U^{3+} stage under any conditions. Fluoride, phosphate and arsenate do not interfere. Chloride, bromide, tungstate, and molybdate interfere. (auth)

11071

DETERMINATION OF TITANIUM BY CUPFERRON WITH COMPLEXONE III AS THE MASKING AGENT. Anil Kumar Majumdar and Jamini Bhusan Ray Chowdhury (Jadavpur Univ., Calcutta, India). Anal. Chim. Acta 15, 105-8(1956) Aug.

The reagent cupferron has been found to be effective for the separation of titanium from Zr^{+4}, Th^{+4}, Fe^{+3}, Al^{+3}, Cr^{+3}, rare earths, Pb^{+2}, Cu^{+2}, Cd^{+2}, Bi^{+3}, Sb^{+3}, Zn^{+2}, Mn^{+2}, Ni^{+2}, Co^{+2}, Mg^{+2}, Ca^{+2}, Ba^{+2}, Sr^{+2}, alkalis, AsO_3^{-3}, AsO_4^{-3}, VO_4^{-3}, MoO_4^{-2}, WO_4^{-2} and $B_4O_7^{-2}$ in the presence of complexone III at a pH between 4.3 and 7.0. Tin (II and IV), uranium (IV and VI), beryllium and phosphate interfere. (auth)

11072

THE THERMOLYSIS OF THE 8-QUINOLINOL CHELATES OF YTTRIUM AND THE RARE EARTH ELEMENTS. Wesley W. Wendlandt (Texas Tech. Coll., Lubbock). Anal. Chim. Acta 15, 109-13(1956) Aug.

The thermolysis of the 8-quinolinol chelates of Y, La, Ce^{3+}, Pr, Nd, Sm, and Gd were studied on the thermobalance. It was found that the thermolysis of the chelates proceeded in three stages: (1) a small loss in weight (about 1%) in the temperature range 250 to 300°; (2) the oxidation of the organic material in the temperature range 350 to 525°; (3) the formation of the oxide in the temperature range 700 to 800°. The method of homogeneous precipitation was introduced to form chelates corresponding to the general formula, $M(C_9H_6NO)_3$. The rare earth metals can be weighed in this form or ignited to the oxides in the temperature ranges specified by the thermolysis curves. (auth)

11073

ANALYTICAL USE OF THE ^{27}Al (α,n) ^{30}P REACTION. Erik Odeblad and Stig Odeblad (Sabbatsbergs Hospital, Stockholm, Sweden). Anal. Chim. Acta 15, 114-17(1956) Aug.

The Al^{27} (α,n) P^{30} reaction has been used to detect Al in different specimens. A Po^{210} alpha source was used. The over-all method error in one determination was about 5%. Binary systems containing Al are expected to be most favorable for analysis. (auth)

11074

RADIOACTIVATION ANALYSIS OF ARSENIC IN TUNGSTEN. J. A. James and D. H. Richards (British Thomson-Houston Co. Ltd., Rugby, England). Anal. Chim. Acta 15, 118-21(1956) Aug.

A radioactivation method has been devised for the determination of As impurity in W powder. Investigations to determine the minimum number of distillations required for radio-chemical purity are described. (auth)

11075

PAPER CHROMATOGRAPHY OF INORGANIC IONS. XIV. SEPARATION OF GADOLINIUM GROUP RARE EARTHS. M. Lederer (Institut du Radium, Paris, France). Anal. Chim. Acta 15, 122-4(1956) Aug.

The gadolinium group rare earths were separated by paper chromatography using ethanol 90 (ml), 2N HCl (10 ml) and NH_4CNS (I g) as solvent. Complete separation of the mixture Nd–Sm–Eu was achieved. The spots of Eu–Gd–Tb overlap slightly, but Eu may be separated well from Tb. (auth)

11076

A STUDY OF THE CONDITIONS FOR THE FORMATION OF NIOBIUM THIOCYANATE. A. Bacon and G. W. C. Milner (U. K. Atomic Energy Authority, Harwell, Berks, England). Anal. Chim. Acta 15, 129-40(1956) Aug.

Solution conditions for the formation of the niobium thiocyanate complex in an aqueous-acetone homogeneous medium have been examined in detail. New conditions have been developed for the formation of a stable thiocyanate complex, such that its absorbancy is not critically dependent upon changes in the reagent concentrations. Linear and reproducible calibration graphs are produced for amounts of niobium in the range 0 to 2 μg/ml and a wide range in the amounts of potassium bisulfate and tartaric acid used in the preparation of the niobium solutions is permissible. Titanium gives rise to interference, but for low ratios of titanium to niobium it is possible to apply a correction for this element. For high ratios the separation of the niobium from the titanium is desirable. (auth)

11077

THE SPECTROPHOTOMETRIC DETERMINATION OF VANADIUM AS THIOCYANATE IN ACETONE–WATER MEDIUM. H. I. Feinstein (U. S. Geological Survey, Washington, D. C.). Anal. Chim. Acta 15, 141-4(1956) Aug.

A method devised for the spectrophotometric determination of V in acetone–water medium is based on the reaction between V^{4+} and thiocyanate. Within the concentration limits tested, Beers law is obeyed. This method is not as sensitive as the peroxide method, but the vanadium(IV)–thiocyanate reaction product shows greater absorbancy than the blue vanadyl ion. In the absence of interfering elements, the method can be used in place of the volumetric procedure for the determination of macro quantities of vanadium. (auth)

11078

DETERMINATION OF SMALL AMOUNTS OF DEUTERIUM OXIDE IN WATER BY INFRA-RED SPECTROSCOPY. Ulla Berglund-Larsson (Nobel Inst. of Chemistry, Stockholm, Sweden). Acta Chem. Scand. 10, No. 4, 701-2(1956).

An improved infrared spectroscopic method for D in H_2O is described wherein the absorption band of HDO at 3.98μ is well separated and Beer's law is obeyed. The absolute mean error in a single determination is found to be ±0.006 wt.% for concentration to 1.3% D_2O. (T. R. H.)

11079

ANALYTICAL ASPECTS OF SOME ORGANIC COM-

POUNDS. PART IV. DETERMINATION OF THORIUM WITH 1-HYDROXY-2-NAPHTHOIC ACIDS. Sachindra Kumar Datta. J. Indian Chem. Soc. 33, 394-8(1956) June.

Thorium has been estimated by 1-hydroxy-, 1-hydroxy-4-bromo- and 1-hydroxy-4-nitro-2-naphthoic acids at pH ranges from 3 to 5.2. Thorium may be separated from cerite earths and monazite sand. The common metals like Ba, Ca, Sr, Mg, Zn, and Ti do not interfere. Thorium could not be separated from Zr with these acids. (auth)

11080

SPECTROPHOTOMETRIC ESTIMATION OF URANIUM(VI) BY MORELLIN. B. R. Lakshman Rao and C. C. Patel. Proc. Indian Acad. Sci. 43A, 276-85(1956) May.

The spectrophotometric estimation of uranium (VI) has been studied by employing morellin, which forms a reddish brown complex with uranyl solution in ethanol medium. The complex is stable between the pH 5 and 7 and the mole ratio of morellin to uranyl ions in the 4-co-ordinate inner complex of UO_2^{++} radical is 2 : 1. The color reaction conforms to Beer's law at 540 mμ in two ranges, 2 to 6 ppm and 12 to 51 ppm of uranium. The limits of interference due to some foreign ions during the spectrophotometric estimation of uranium have been determined. (auth)

11081

A NEW REAGENT FOR THE DETERMINATION OF THORIUM. M. R. Verma, K. C. Agrawal, and S. D. Paul (National Physical Lab. of India, New Delhi). Nature 178, 324(1956) Aug. 11.

11082

UTILIZATION OF AN IMPULSION DISCRIMINATOR ATTACHED TO A γ SCINTILLATION DETECTOR FOR ACTIVATION ANALYSIS. R. Chauvin and P. Lévêque (C. E.N., Saclay, France). Intern. J. Appl. Radiation and Isotopes 1, 115-22(1956) July. (In French)

11083

ULTRAVIOLET SPECTROPHOTOMETRIC DETERMINATION OF NICKEL WITH α-BENZILDIOXIME. Yasumitsu Uzumasa and Shigenari Washizuka (Hokkaido Gakugei Univ., Asahigawa, Japan). Bull. Chem. Soc. Japan 29, 403-7(1956) Apr.

A new method described here involves the extraction of nickel (II)-benzildioxime with chloroform and the spectrophotometric measurements of the colored system in the same solvent. The wide pH range for the extraction eliminates the use of a buffer, and nickel is readily separated from ferric iron, aluminum, zinc, chromate, vanadate, and molybdate ions. By obviating the excessive benzildioxime with dilute alkali, the most sensitive absorbance readings are achieved, and the sensitivity at 275 m μ is 0.0013. Beer's law holds up to 1 ppm of nickel at 275 m μ, and up to 4 ppm at 358 and 406 m μ. The nature and degree of interference of copper and cobalt on the color development are also discussed, and their allowable amounts are determined. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

11084

THE CRYSTAL STRUCTURE OF NbO_2F AND TaO_2F. L. K. Frevel and H. W. Rinn (Dow Chemical Co., Midland, Mich.). Acta Cryst. 9, 626-7(1956) Aug.

Niobium dioxyfluoride and tantalum dioxyfluoride have the ReO_3 structure in which fluorine atoms and oxygen atoms are randomly distributed in octahedral positions about the metal atom. The simple cubic unit cell for NbO_2F has a = 3.902 ± 0.001 A; and for TaO_2F, a = 3.896 ± 0.003 A. (auth)

11085

X-RAY STUDY OF THE ALKALI METALS AT LOW TEMPERATURES. C. S. Barrett (Univ. of Chicago). Acta Cryst. 9, 671-7(1956) Aug.

Using a spectrometer having provision for cold working and x raying specimens in a high vacuum at low temperatures, it is found that sodium partially transforms on cooling (below 36°K) or on deforming (below 51°K) to a close-packed hexagonal structure with stacking faults, having a = 3.767, c = 6.154 A, c/a = 1.634 at 5°K, this coexisting with body-centered cubic sodium of a_0 = 4.225 A. The body-centered cubic form at 78°K has a_0 = 4.235 A. Severe cold work at 5°K transforms about half of the material to the hexagonal form; subsequent reversion to cubic starts on heating to 60 to 75°K and is completed at 100 to 110°K, or at lower temperatures if there has been no cold work. Reversion can be aided by cold work at 45 to 100°K. High purity severely deformed sodium recrystallizes at 98°K. Patterns of lithium that has been cooled can be interpreted similarly, and indicate a phase of close-packed hexagonal structure with parameters a = 3.111, c = 5.093 A, c/a = 1.637 (which differ from the earlier, tentative ones). This phase coexists with the body-centered cubic phase of a_0 = 3.491 A, at 78°K. Confirming the earlier work, hexagonal lithium is converted to face-centered cubic by cold working. Potassium, rubidium and cesium retain their body-centered cubic structure after cooling and cold working at 5°K, with a_0 = 5.225, 5.585, and 6.045 A respectively at 5°K and with a_0 = 5.247, 5.605 and 6.067 A at 78°K. (auth)

11086

SYMMETRY RELATIONS AMONG COEFFICIENTS OF THE ANISOTROPIC TEMPERATURE FACTOR. Henri A. Levy (Oak Ridge National Lab., Tenn.). Acta Cryst. 9, 679(1956) Aug.

11087

THE STRUCTURE OF TiF_3. Stanley Siegel (Argonne National Lab., Lemont, Ill.). Acta Cryst. 9, 684(1956) Aug.

Each Ti atom occupies the center of a slightly distorted octahedron formed by six F atoms, with Ti−6 F = 1.97 ± 0.02 A. The F atoms lie in planes normal to the [111] direction, and an octahedron is formed from three F in each plane on either side of a Ti atom. The normal distance between a Ti atom and a F plane is 1.13. The F to F distances within the octahedra are 2.78 ± 0.02 and 2.79 ± 0.20 A. (W.L.H.)

11088

THE CRYSTAL STRUCTURE OF $U(SO_4)_2 4H_2O$. Peder Kierkegaard (Univ. of Stockholm, Sweden). Acta Chem. Scand. 10, No. 4, 599-616(1956).

Uranium(IV) Sulfate tetrahydrate has an orthorhombic unit cell containing four formula units and with the dimensions: a = (14.674 ± 0.005), b = (11.093 ± 0.005), c = (5.688 ± 0.005), and V = 925.8$_9$ A^3. A structure is proposed with atomic positions in the space group No. 62 Pnma. The positions of the U and S atoms were determined with Fourier methods. The parameters of the O atoms were deduced from geometrical considerations, using interatomic distances from previously determined structures. The crystals are built up of layers parallel to the yz plane and formed by U atoms and SO_4 groups. The layers are held together by H_2O molecules, so that each SO_4 tetrahedron has two O atoms linked with hydrogen bonds to adjacent H_2O molecules. Every U atom is in contact with four SO_4 groups and four H_2O molecules, so that the coordination of O atoms around U is eightfold in the shape of a square Archimedean antiprism. (auth)

11089

X-RAY INVESTIGATIONS ON URANYL HYDROXIDES. I.

THE CRYSTAL STRUCTURE OF β-$UO_2(OH)_2$. Gunilla Bergstrom and Georg Lundgren (Research Inst. of National Defence, Sundbyberg; Royal Inst. of Tech., Stockholm; and Univ. of Stockholm, Sweden). Acta Chem. Scand. 10, No. 4, 673-80(1956).

Beta uranyl hydroxide has a face-centered orthorhombic cell with the dimensions a = 6.295 ± 0.005 A, b = 5.636 ± 0.005 A, and c = 9.92_9 ± 0.01 A. The unit cell contains four formula units. The atomic positions can be described by the space group No. 69 Fmmm. The structure is built up of pseudotetragonal layers connected by van der Waals contact between the UO_2^{2+} groups. Every U atom is joined through four atoms to its neighbouring U atoms. The positions of the O atoms were inferred from geometrical arguments and considerations of the strength of the U—O bonds. (auth)

11090

THE CRYSTALLIZATION OF VITREOUS WATER AND HEAVY WATER. H. J. de Nordwall and L. A. K. Staveley (Inorganic Chemistry Lab., Oxford, England). Trans. Faraday Soc. 52, 1061-6(1956) Aug.

Ordinary water and heavy water have been prepared in a partially vitreous condition by slow condensation of the vapour on a surface cooled in liquid air or oxygen. When the deposit from ordinary water was heated a small amount of heat was evolved between ~105 and 130°K and a larger amount between 141 and 160° K. The transformation process therefore proceeds in stages. Since reorientation processes in ice and water are characterized by only one relaxation time for each medium, it is tentatively suggested that crystallization of partially vitreous H_2O requires both orientation of the molecules as well as their translation with respect to each other and that these processes do not occur simultaneously. The crystallization of partially vitreous D_2O is accompanied by an evolution of heat between 142 and 160° K which also involves more than one stage, but no evolution of heat could be detected at lower temperatures corresponding to the effect observed for H_2O between 105 and 130° K. (auth)

11091

CRYSTALLOGRAPHIC DATA: TRIPOTASSIUM DIURANYL HEPTAFLUORIDE DIHYDRATE, $K_3(UO_2)_2F_7.2H_2O$. D. I. Walker, Don T. Cromer, and Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 1501(1956) Sept.

Refer also to abstracts 11106 and 11356.

DEUTERIUM AND DEUTERIUM COMPOUNDS

11092

INFRARED SPECTRA OF HYDROGEN CYANIDE AND DEUTERIUM CYANIDE. Harry C. Allen, Jr., Eugene D. Tidwell, and Earl K. Plyler (National Bureau of Standards, Washington, D. C.). J. Chem. Phys. 25, 302-7(1956) Aug.

The infrared spectra of HCN and DCN have been investigated in the region 1900 to 8000 cm^{-1}. Twenty-two bands of HCN and eighteen bands of DCN were measured. The newly measured bands together with previously known bands enable a complete determination of the vibrational anharmonic constants for the two molecules. A third-order resonance between levels of the type (v_1, v_2^1, v_3) and $(v_1 + 3, v_2^1, v_3 - 2)$ is shown to be present in the HCN vibrational energy-level system. (auth)

11093

ISOTOPIC EXCHANGE BETWEEN DEUTERIUM AND HYDROCARBONS ON NICKEL—SILICA CATALYSTS. Robert L. Burwell, Jr. and Richard H. Tuxworth (Northwestern Univ., Evanston, Ill.). J. Phys. Chem. 60, 1043-9(1956) Aug.

The effect of temperature, of the ratio of deuterium to hydrocarbon, and of nickel crystallite size upon the isotopic exchange reaction between hydrocarbon and deuterium is reported for nickel-silica catalysts which have been characterized by the magnetic method of Selwood. Cyclohexane and, to a lesser extent, heptane, cyclopentane and (+) 3-methylhexane have been employed as test hydrocarbons. Increasing multiple exchange of the hydrocarbon results from increased temperature, decreased ratio of deuterium to hydrocarbon, and increased crystallite size. In large measure, the increased multiple exchange probably results from increased availability of the free surface sites which are required for the propagation reaction leading to multiple exchange. At 60 to 150°C, the concentrations of the exchanged species of cyclohexane exhibit a discontinuity between $C_6H_6D_6$ and $C_6H_5D_7$. At higher temperatures no such discontinuity is apparent. The propagation reaction does not pass readily from one set of six hydrogen atoms to the other at lower temperatures. Cyclopentane behaves similiarly. In the hydrogenation of 1-hexene with deuterium at about 100°, decrease in partial pressure of olefin results in increasing multiple introduction of deuterium, presumably owing to the increased availability of free sites with the decreased partial pressure of the strongly adsorbed olefin. (auth)

11094

THE MICROPORE FLOW OF H_2O AND D_2O THROUGH ACTIVATED CARBON RODS. M. E. Huber, E. A. Flood, and R. D. Heyding (National Research Council, Ottawa, Canada). Can. J. Chem. 34, 1288-1301(1956) Sept.

The flow rates of water adsorbed on activated charcoal have been measured at temperatures between −24 and +35°C and compared with the flow rate of adsorbed D_2O at 25°C. From flow data, the relative viscosity of adsorbates can be calculated. Above 0°C the viscosity of the adsorbate shows nearly the same temperature dependence as liquid water; below 0°C the viscosity increases much more rapidly, but there is no sudden increase which could be ascribed to freezing of an appreciable fraction of the adsorbate at any particular temperature. The greater temperature coefficient of the adsorbate viscosity is consistent with a viscous flow of liquid films over a solid surface which exerts attractive forces on the liquid. (auth)

11095

THE ISOTOPIC EXCHANGE BETWEEN HYDROGEN AND WATER ON PLATINUM. RELATIVE RATES OF EXCHANGE OF ISOTOPIC HYDROGEN MOLECULES. Kare Hannerz (Royal Inst. of Tech., Stockholm, Sweden). Acta Chem. Scand. 10, No. 4, 655-66(1956).

The isotopic exchange between D- and T- containing H_2 and ordinary H_2O vapor on Pt has been investigated using mass spectrometric and radiotracer techniques. A certain amount of HD is formed when D_2 exchanges with D- free H_2O vapor. The rate of HD formation shows that the exchange cannot be due to the interaction of a D_2 molecule, from the gas phase or from the van der Waals layer, with a chemisorbed H atom or OH radical. It is necessary to assume that both the H_2 molecule and the H_2O undergo a dissociative chemisorption on the surface. The ratio of the rates of chemisorption of HD and D_2 has approximately the value given by the simple collision theory for a reaction without activation energy. This points to the possibility that H_2 is chemisorbed without activation energy on bare dual sites on the surface, formed by the desorption of H_2O or H_2. (auth)

11096

CONTINUOUS MEASUREMENT OF DEUTERIUM CONCENTRATION BY MEANS OF THERMAL CONDUCTIVITY. M. Silvestri and N. Adorni (CISE, Milan, Italy). Rev. Sci. Instr. 27, 388-91(1956) June.

A continuous analytical device for the measurement of deuterium concentration in hydrogen gas is described based on differences in the thermal conductivities of the hydrogen isotopic molecules and the use of a Gow-Mac thermal conductivity unit. Calibration of the apparatus in the range 0-2.5% D/(D + H) was performed, showing that accuracy of the order of 1/10,000 can easily be achieved with well-purified gases. (auth)

Refer also to abstract 11078.

FLUORINE AND FLUORINE COMPOUNDS

11097 NP-6090

Battelle Memorial Inst., Columbus, Ohio.

POLYMERIZATION STUDIES ON MONOMERS AND EVALUATION OF DERIVATIVE POLYMERS. Quarterly Progress Report No. 2 [for] June 1, 1956 to September 1, 1956. F. B. Jones, C. A. Lichtenwalter, P. B. Stickney, and R. G. Heiligmann. Sept. 1, 1956. 31p. Project No. 6-(8-7340). Contract AF33(616)-3313.

Investigations were made of the polymerization characteristics of six different fluorinated olefin oxides. $FeCl_3$ and $AlCl_3$ were found to be effective catalysts for the mass polymerization of these materials. (W.L.H.)

11098 WADC-TR-53-427

Ohio State Univ. Research Foundation, Columbus.

THERMODYNAMIC CALCULATIONS OF THE PERFORMANCE OF THE HYDROGEN–FLUORINE SYSTEM. Rudolph Edse and William L. Doyle. Mar. 1956. 55p. Project title: LIQUID ROCKET ENGINE TECHNOLOGY. Contract AF33(616)-2078. (AD-92491).

Values of the specific impulse of the hydrogen–fluorine system were calculated for various chamber pressures and mixture ratios. Both pure fluorine and technical fluorine containing 4% nitrogen by weight were considered. The results were derived from enthalpy-entropy diagrams which were prepared for the chamber and the exhaust gases for the case that complete thermodynamic and chemical equilibrium prevails at all times of the rocket engine process. A detailed discussion of the method of computation has been included in the report. Finally, a critical analysis was made of the usefulness of the isentropic expansion coefficient and the characteristic exhaust velocity for a less cumbersome calculation of the performance of rocket propellants. It is concluded that accurate values of the specific impulse of rocket propellants can be derived only from enthalpy-entropy diagrams of the chamber and the exhaust gases. (auth)

11099

SYNTHESIS AND PROPERTIES OF SOME FLUORO-BIS (ETHYLENEDIAMINE)–COBALT(III) COMPLEXES. William R. Matoush and Fred Basolo (Northwestern Univ., Evanston, Ill.). J. Am. Chem. Soc. 78, 3972-6(1956) Aug. 20.

A somewhat different approach to the synthesis of fluoroamminecobalt(III) salts is presented. Preparation of five new complexes is described and the isolation of optically active compounds containing a metal-fluoride bond is reported for the first time. Isolation of such optically active forms provides a proof of structure for three different pairs of geometric isomers. Reactions of dextro-$[Coen_2F_2]^+$ give no evidence for a Walden inversion type reaction as is known for levo-$[Coen_2Cl_2]^+$. (auth)

11100

THE NUCLEAR MAGNETIC RESONANCE SPECTRA OF F^{19} IN METHYL- AND ETHYFLUOROSILANES. Erhard Schnell and Eugene G. Rochow (Mallinckrodt Chemical Lab., Cambridge, Mass.). J. Am. Chem. Soc. 78, 4178 (1956) Aug. 20.

The chemical shifts of $(CH_3)_xSiF_{4-x}$ and $(C_2H_5)_xSiF_{4-x}$ and SiF_4 in c.p.s. in a magnetic field of 9,989 gauss and referred to $(C_2H_5)_2SiF_2$ were measured and are reported. The extent of magnetic shielding of F in fluorosilanes is discussed. (T.R.H.)

11101

INFRARED SPECTRUM OF HYDROGEN FLUORIDE. G. A. Kuipers and D. F. Smith (Oak Ridge Gaseous Diffusion Plant, Tenn.) and A. H. Nielsen (Univ. of Tennessee, Knoxville). J. Chem. Phys. 25, 275-9(1956) Aug.

The infrared vibration-rotation spectrum of HF has been re-examined out through J = 11 for the fundamental, and through J = 8 for the first overtone. Five lines of the pure rotational spectrum of HF (J = 10, 11, 12, 14, 15) have been observed in absorption and emission between 15 and 24μ. Extension of the measurement to larger J values makes it possible to observe the effect of the term $H_vJ^3(J+1)^3$ in the energy, and to obtain H_v. With the new data the molecular constants have been re-evaluated by IBM machine. These constants when used with the energy expression permit accurate prediction of the observed energy levels. (auth)

11102

VIBRATIONAL SPECTRA OF FORMYL FLUORIDE AND d-FORMYL FLUORIDE. H. W. Morgan, P. A. Staats, and J. H. Goldstein (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 25, 337-42(1956) Aug.

The vibrational spectra of HCOF and of DCOF have been examined in the gas and solid phases by infrared techniques and in the liquid phase through the Raman effect. Of the six expected fundamentals for a molecule of point group C_s, frequencies have been assigned to the five planar vibrations and a tentative assignment made for the nonplanar vibration. A normal coordinate analysis was applied to the A' vibrations of HCOF, neglecting all interaction terms, and a set of force constants obtained which predict reasonably well the isotopic shifts in DCOF. (auth)

11103

CRYSTALLOGRAPHIC EVIDENCE FOR THE TRIHYDRATE OF ALUMINUM FLUORIDE. Robert D. Freeman (Goodyear Atomic Corp., Portsmouth, Ohio). J. Phys. Chem. 60, 1152 (1956) Aug.

The existence of a hydrate of AlF_3 which contains either 3.0 or 3.5 moles of H_2O per mole of AlF_3 has been well established. (W. L. H.)

11104

RAPID ION-EXCHANGE METHOD FOR DETERMINING TOTAL FLUORIDE IN IMPURE KF.HF. F. A. Koehler and W. A. Levier (Goodyear Atomic Corp., Portsmouth, Ohio). Science 124, 175(1956) July 27.

11105

BERYLLIUM FLUORIDES. PART I. STUDIES ON HYDROLYSIS OF FLUOBERYLIATE ION (BeF_4^{2-}) BY CONDUCTIVITY AND THERMOMETRY. Apurba Kumar Sen Gupta. J. Indian Chem. Soc. 33, 433-6(1956) June.

By conductivity, thermometry and chemical methods it has been shown that the primary reaction between NaOH and BeF_4^{2-} occurs according to the equation: $BeF_4^{2-} + 2OH^- = Be(OH)_2 + 4F$; the secondary reaction, i.e. the dissolution of $Be(OH)_2$ in excess of alkali, occurs subsequently, forming beryllate ion; no indication of the formation of $[BeF_3OH]^-$ has been found. (auth)

11106

ON THE POLYMORPHISM OF BERYLLIUM FLUORIDE. D. F. Kirkina, A. V. Novoselova, and Yu. P. Simanov. (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 107, 837-8(1956) Apr. 21. (In Russian)

Thermographic and x-ray studies were made for tetragonal BeF_2 of cristobalite structure. The cristobalite BeF_2 was formed by decomposing ammonium fluoroberyllate. For thermographic investigations a platinum crucible containing BeF_2 was placed into a tightly closed steel cylinder to protect it against moisture. The heating curves were recorded on a pyrometer with differential thermocouple. MgO_2 was used as the standard. The x-ray investigation was made in phosphate glass capillary at temperature up to 545° in a chamber of 190.05 mm in diameter. Endothermal effects were observed at 130 and 545°, and on some thermograms at 400°. X-ray studies showed that at 130° tetragonal BeF_2 converts into cubic structure. At 545° BeF_2 begins to melt. Tabulations and diagrams are presented. (R.V.J.)

Refer also to abstracts 11066, 11272, 11397, 11451, and 11452.

GRAPHITE

11107 NAA-SR-1627

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

X-RAY MEASUREMENTS OF IRRADIATED GRAPHITE ANNEALED AT ELEVATED TEMPERATURES. S. B. Austerman. Sept. 15, 1956. 14p. Contract AT-11-1-GEN-8. $0.20(OTS).

X-ray measurements of lattice constant expansion in graphite during neutron irradiation and subsequent thermal anneals are presented. During irradiation of AGOT-KC graphite at $\lesssim$30°C in the Hanford Reactor, expansion occurred at a rate of about 0.77 per cent/100 Mwd/ct up to 460 Mwd/ct. The energy represented by this expansion is shown to be negligible in comparison with the theoretical energy of interstitial formation. The rate of expansion per interstitial atom appears to be constant, and the removal of interstitials from the lattice during thermal annealing appears uniform with temperature, up to at least 460 Mwd/ct irradiation. Annealing rates of a very heavily irradiated specimen show some temperature dependence, as well as a relatively high temperature for cessation of annealing. (auth)

11108

PROCEEDINGS OF THE FIRST AND SECOND CONFERENCES ON CARBON. Buffalo, Univ. of Buffalo, 1956. 222p.

Papers from the first and second conferences on carbon are included giving a limited but valuable review of the latest research in the field. (F. S.)

11109

THERMAL CONDUCTIVITIES OF POLYCRYSTALLINE CARBONS AND GRAPHITES. C. P. Jamieson and S. Mrozowski (Univ. of Buffalo, N. Y.). pp. 155-66 of Proceedings of the Conferences on Carbon, Univ. of Buffalo, N. Y., 1956.

The dependence of the thermal conductivity K of polycrystalline carbons and graphites on the mean crystallite diameter L_a was experimentally investigated for ambient temperatures ranging from 100 to 400°K. The conductivities were determined by the standard method of measuring the temperature gradient established along the axis of a cylindrical specimen by a definite power input. The mean crystallite diameters were determined from the broadening of x-ray-diffraction lines. For well-graphitized samples the thermal resistivity, 1/K, varies almost linearly with the reciprocal of mean crystallite diameter $1/L_a$. For such samples the thermal resistivities can be separated into two parts which correspond to scattering by the boundaries of crystallites and to the mutual lattice-wave scattering. The dependence of the lattice scattering on temperature and the values of the corresponding free paths are obtained by linear extrapolation to $1/L_a \rightarrow 0$. For poorly- and non-graphitized carbons the thermal resistivity increases much faster than linearly with increase of $1/L_a$. Possible reasons for the breakdown of Debye's linear relationship are discussed. (auth)

11110

DIMENSIONAL CHANGES DURING HEAT TREATMENT AND THERMAL EXPANSION OF POLYCRYSTALLINE CARBONS AND GRAPHITE. F. M. Collins (Univ. of Buffalo, N. Y.). pp. 177-87 of Proceedings of the Conferences on Carbon, Univ. of Buffalo, N. Y., 1956.

Measurements of irreversible changes of length during heat treatment of carbon from 1100 to 2800°C, and of the thermal expansion of the resultant graphite were made on rods within a furnace using two externally mounted short range telescopes. Extruded carbon rods made from Texas coke, Kendall coke, and a hard coke were investigated. A number of rods were prepared from each coke calcined to different temperatures. The dependence of both the changes of length during heat treatment and of the thermal expansion upon the coke calcination temperature and particle size were studied. Data concerning the influence of impregnation on the thermal expansion of rods made from Kendall coke were obtained. (auth)

11111

PHYSICAL PROPERTIES OF CARBONS AND THE FORMULATION OF THE GREEN MIX. S. Mrozowski (Univ. of Buffalo, N. Y.). pp. 195-215 of Proceedings of the Conferences on Carbon, Univ. of Buffalo, N. Y., 1956.

The dependence of different physical properties of carbons and polycrystalline graphites upon the porosity introduced in the manufacturing process is analyzed. The apparent (bulk) density, d, of the material is a function of two variables: the density of the coke filler, d_0 (mass of filler per unit volume of bulk material), and the density of the binder coke, $(d-d_0)$. Making a number of simplifying assumptions as to the distribution of the binder coke and as to the statistics of the interparticle contacts, the following relations are derived: For the moduli of elasticity, rigidity and volume expansion, $E = E_0 d_0^x (d-d_0)$; for the mechanical strength, $S = S_0 d_0^y (d-d_0)$; and for the electric and heat conductivities, $1/\rho = (1/B) d_0^x (d-d_0)^{\frac{1}{2}}$. It is shown that the exponents must satisfy the relations $x = z + \frac{1}{2}$ and $y > z$. The coefficients E_0, S_0 and $1/B$ are proportional to the respective values for the dense material: S_0 is inversely proportional to some fractional power of the radius of coke particles. Adaptation of the formulas to cases of different binder-coke types, coke particles with internal porosity, non-equiaxed particles and mixture of particles of two sizes are discussed. It is further shown that the formulas derived make possible an analysis of a carbon from which information can be obtained as to the formulation of the original mix. The method is illustrated by using data obtained by K. Hong on the elastic modules and electric resistivity for a batch of extruded baked carbon rods, for which it is found $E = 4 \times 10^{11}$ (d−1.26) dynes/cm^2 and $1/\rho^2 = 2 \times 10^8$ (d−1.28) mho^2/cm^2. A consideration of the limitations imposed on the relative values of d_0 and $(d-d_0)$ by the manufacturing process (compression of the green mix) leads to predictions as to the optimum conditions for the mechanical strength, elastic moduli and conductivities. (auth)

11112

DENSITY-RESISTIVITY RELATIONSHIPS FOR BAKED CARBONS. E. J. Seldin (Univ. of Buffalo, N. Y.). pp. 217-22 of Proceedings of the Conferences on Carbon, Univ. of Buffalo, N. Y., 1956.

Carbon samples were prepared by molding mixtures of petroleum coke particles and coal tar pitch and baking

them to 1000°C. The coke particle size, the binder content and the molding pressure were varied so as to give samples with a wide variation in apparent density d, filler density d_0 and resistivity ρ. The apparent densities of samples were increased by impregnation with pitch and rebaking. The relationships between apparent density, filler density and electrical resistivity were investigated and the range of applicability of Mrozowski's formula was experimentally tested. The results yield information concerning an undetermined parameter in the theory. (auth)

11113
HEAT OF REACTION OF IRRADIATED GRAPHITE WITH POTASSIUM. W. Primak and L. A. Quarterman (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 78, 3879-81(1956) Aug. 20.

The heats of reaction of fast neutron irradiated graphite samples and K were determined. The difference between the specific heats of reaction of irradiated and unirradiated graphite (excess heat of reaction) was in all cases much smaller than the difference between the specific heats of combustion of the respective irradiated graphite samples and unirradiated graphite (excess heat of combustion; energy content). The excess heat of reaction as a function of irradiation was found to saturate sooner than the energy content. A single determination indicated that hydrocarbons are produced in small quantity in the hydrolysis of the irradiated graphite–potassium compound but not in the hydrolysis of the unirradiated graphite–potassium compound suggesting the formation of some potassium carbide in the reaction of irradiated graphite and potassium. (auth)

LABORATORIES AND EQUIPMENT

11114 IDO-14379
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
EFFECTIVENESS OF VARIOUS SOLUTIONS FOR DECONTAMINATING STAINLESS STEEL, LEAD AND GLASS. John B. Huff. May 24, 1956. 21p. Contract AT(10-1)-205. $0.35(OTS).

The results of a series of comparative tests are presented in three tables. Spots were uniformly contaminated on lead, glass, and stainless steel surfaces. The effectiveness of various reagents and proprietary compounds toward removal of radiocontaminants was studied. Some solutions were found to be thousands of times more effective than certain commonly used cleaning agents. It is concluded that separate techniques are generally required for decontaminating the individual materials. (auth)

11115
HYGIENIC AND SANITARY-TECHNICAL REQUIREMENTS IN PLANNING AND OUTFITTING LABORATORIES USING RADIOACTIVE SUBSTANCES. V. P. Granil'shchikov and G. M. Parkhomenko. Med. Radiol. No. 3, 42-52(1956) May-June. (In Russian)

11116
SAFE CONTAINERS HOLD ORGANICS FOR IRRADIATIONS. N. P. Shiells, R. O. Bolt, J. G. Carroll (California Research Corp., Richmond). Nucleonics 14, No. 8, 54-7(1956) Aug.

Equipment has been developed for reactor exposures of organic materials at temperatures up to 850°F. Also developed were techniques for loading the containers and a special device for use with greases. (W. L. H.)

11117
DESIGN SPECIAL HOODS FOR MACHINING TOXIC METALS. J. M. Taub (Los Alamos Scientific Lab., N. Mex.). Iron Age 178, No. 7, 91-4(1956) Aug. 16.

The design and efficiency of ventilated hoods for lathes and milling machines used with valuable materials and toxic metals are presented. (J.E.D.)

RADIATION CHEMISTRY

11118 AERE-C/R-1575(6)
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
SELECTED ABSTRACTS OF ATOMIC ENERGY PROJECT UNCLASSIFIED REPORT LITERATURE IN THE FIELD OF RADIATION CHEMISTRY and BIBLIOGRAPHY OF THE PUBLISHED LITERATURE. (Papers Noted up to May 1956). PART 6. MISCELLANEOUS. (INCLUDING INDUSTRIAL APPLICATIONS OF RADIATION, EFFECT OF IRRADIATION ON COLLOIDS, CORROSION EFFECTS, IRRADIATION REQUIREMENT, REVIEW PAPERS, ETC.). R. W. Clarke, comp. May 1956. 57p.

11119 PB-121304
Minnesota. Univ., Austin. Hormel Inst.
CHANGES PRODUCED IN LIPID MATERIALS BY HIGH ENERGY RADIATIONS. Report No. 7 (Termination) [for] April 1, 1954–August 31, 1955. W. O. Lundberg. 29p. Project No. 7-84-01-002. Contract DA-44-109-qm-1754.

The taste and odor changes, and various chemical changes that occurred in a series of prototype fatty materials when subjected to high energy radiations under a variety of conditions, have been investigated. The irradiated samples and appropriate controls were compared organoleptically with a master control kept under vacuum at −20°C. Peroxide values and carbonyl contents were determined; and a number of samples also were examined by ultraviolet and infrared spectroscopy. Corn oil methyl esters, methyl palmitate, methyl oleate, methyl linoleate, corn oil, lard, and butterfat have been irradiated with β and γ rays. The effects of water, emulsifiers, antioxidants, composition of the atmosphere under which the samples were sealed, temperature of irradiation, temperature of storage after irradiation, dose rate, and total dose of irradiation have been studied. Off-flavors and odors developed in all samples of irradiated fat. These flavors and odors, however, were much less pronounced when samples were irradiated in the absence of oxygen. Irradiation also resulted in the formation of peroxides and carbonyl compounds. Irradiation of methyl linoleate in the solid state produced polymers. It is concluded that changes caused by high energy radiation of fats are brought about by a complex series of reactions which may involve the reaction of free radicals with oxygen, ozone, oxides of nitrogen, as well as with each other. The reactions involved in autoxidation account for only a part of the changes caused by irradiation of fats with ionizing radiations. (auth)

11120
DECOMPOSITION OF THE LIQUID ALKYL IODIDES BY 120 KVP. X-RADIATION. Robert H. Schuler and Robert C. Petry (Canisius Coll., Buffalo, N. Y.). J. Am. Chem. Soc. 78, 3954-8(1956) Aug. 20.

The predominant products of the x-ray decomposition of liquid C_2H_5I, n-propyl iodide and isopropyl iodide are I_2 and hydrocarbons of the same carbon number as the parent species. In general, unsaturated hydrocarbons are produced in a somewhat greater yield than saturated hydrocarbons and I_2 is found in an amount in excess of that expected from the observed hydrocarbons. Minor yields of H_2, CH_4, and other hydrocarbons are observed. Net products are formed by processes other than those involving thermal radicals since such radicals are removed by iodine necessarily present. Use of radioiodine in the scavenging reactions has shown that the radical yield results almost entirely from rupture of the carbon-iodine bond. A low

yield of isomerization of n-propyl iodide, similar to the photolysis at 3261 A. but in contrast to that at 2537 A., indicates that a large fraction of the radicals are produced with little excess energy. Attention is called to other characteristic differences between the products of photolysis and radiolysis. (auth)

11121

ACTION OF GAMMA RAYS ON FERROUS ION SOLUTIONS IN HEAVY WATER. Conrad N. Trumbore and A. H. W. Aten, Jr. (Instituut voor Kernphysisch, Amsterdam, Holland). J. Am. Chem. Soc. 78, 4179(1956) Aug. 20.

The action of Co^{60} γ-radiation on solutions of $Fe(NH_4)_2(SO_4)_2$ in H_2O and D_2O mixtures has been investigated and Fe^{3+} ion yields reported for various H_2O-D_2O mixtures. The $G_{Fe^{3+}}$ values are found to depend on the isotope ratio in the free atoms in an almost linear fashion. It is further pointed out that G can also be a function of such quantities as mole % DOD. (T.R.H.)

11122

GAMMA-RAY VULCANIZATION OF RUBBER. S. D. Gehman and I. Auerbach (Goodyear Tire and Rubber Co., Akron, Ohio). Intern. J. Appl. Radiation and Isotopes 1, 102-14(1956) July.

An experimental study was made of the vulcanization of rubber by the cross-linking action of intense gamma radiation from a Co^{60} source. Vulcanization by heat and chemicals is an important, highly developed industrial process, the essential feature of which is the chemical cross linking of the rubber molecules by sulfur atoms. With gamma-ray vulcanization, the cross-linking occurs by the elimination of hydrogen and the formation of carbon-carbon bonds, which are more stable than sulfur bonds. The usual vulcanizing agents and sulfur were found to have only slight influence on gamma-ray vulcanization, but fillers enhanced the effects of the radiation, probably through scattering or other interaction with the photons. The tensile strengths developed with a series of fillers were found to increase with the specific volumes of the fillers. Tensile strengths obtained with gamma-ray vulcanization were not as high as can be secured by conventional vulcanization. The radiation dose required for vulcanization was relatively large, 1 to 5×10^7 rep. If there were no heat losses, such a dose would raise the temperature of the rubber to ordinary vulcanizing temperatures. Typical potential advantages of gamma-ray vulcanization include uniform vulcanization of thick articles, more stable, better ageing vulcanizates, cold vulcanization of extruded shapes or preforms, and faster preliminary processing of the rubber stock. The development of industrial applications of gamma-ray vulcanization may be contingent on the economical utilization of fission-waste products or spent reactor-fuel elements and developments in the technology of working with intense radiations. (auth)

11123

EFFECT OF TEMPERATURE UPON THE CROSS-LINKING OF POLYETHYLENE BY HIGH-ENERGY RADIATION. R. M. Black (British Insulated Callender's Cables, Ltd., London). Nature 178, 305-6(1956) Aug. 11.

RADIATION EFFECTS

11124 APEX-167

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

RADIATION DAMAGE TO NON-METALLIC MATERIALS. V. P. Calkins. Aug. 1954. 36p. $0.30(OTS).

The mechanism of radiation damage is discussed in a general way and is then used to make generalizations as to the extent, types, and prevention or diminution of radiation damage to non-metallic reactor materials. (T.R.H.)

11125 NP-6088

Quartermaster Food and Container Inst., Chicago.

IONIZING RADIATIONS: THEIR PRODUCTION, EFFECTS, AND UTILIZATION (WITH SPECIAL REFERENCE TO FOOD AND PACKAGING TECHNOLOGY). Bibliographic Series No. 4. Supplement No. III. June 1956. 251p.

Subject Index for Supplement No. III issued as NP-6089.

11126 NP-6089

Quartermaster Food and Container Inst., Chicago.

IONIZING RADIATIONS: THEIR PRODUCTION, EFFECTS, AND UTILIZATION (WITH SPECIAL REFERENCE TO FOOD AND PACKAGING TECHNOLOGY). Bibliographic Series No. 4. Supplement No. III. Subject Index. June 1956. 119p.

This is a Subject Index for Supplement No. 3 issued as NP-6088.

RARE EARTHS AND RARE-EARTH COMPOUNDS

11127 AEC-tr-2630

MAGNETIC PROPERTIES OF SOME RARE EARTH METALS AND OXIDES. C. Henry La Blanchetais. Translated by Gabrielle Wohlauer from J. recherches centre natl. recherche sci. Labs., Bellevue (Paris) 6, 125-33 (1954). 24p.

These studies on Ce and Pr as metals and as trivalent oxides verify the classic laws of paramagnetism. Data to support this statement are given. Variations are probably due to impurities or inconsistencies in definition of chemical composition. (T.R.H.)

11128

TERBIUM OXIDES. II. THE HEATS OF FORMATION OF SEVERAL OXIDES. C. T. Stubblefield, H. Eick, and L. Eyring (State Univ. of Iowa, Iowa City). J. Am. Chem. Soc. 78, 3877-9(1951) Aug. 20.

Three stable oxides of Tb were prepared, including two of non-stoichiometric composition, and their heat of reaction measured in an adiabatic microcalorimeter. The heats of reaction at 25° of $TbO_{1.560}$, $TbO_{1.71}$ and $TbO_{1.80}$ in 6.00M HNO_3 containing a small concentration of Na_2SiF_6 were found to be -47.2 ± 0.3, -42.3 ± 0.5 and -39.2 ± 0.5 kcal/mole, respectively. These values when combined with other data yielded the corresponding molal heats of formation for TbO_x of -218.4 ± 1.0, -223.3 ± 1.0, and -226.4 ± 1.0 kcal/mole, respectively. (auth)

11129

KINETICS OF THE IODIDE-CATALYZED REACTION BETWEEN CERIUM(IV) AND ARSENIC(III). John Stanley Yates and Henry C. Thomas (Yale Univ., New Haven, Conn.). J. Am. Chem. Soc. 78, 3950-3(1956) Aug. 20.

The rates at 25° of reactions in H_2SO_4 solutions between $Ce(SO_4)_2$ and arsenious acid catalyzed by iodide have been measured for a variety of concentrations of reactants and catalyst. A mechanism for the reaction is proposed. Except at low Ce/As ratio, a steady-state equation derived from the mechanism adequately describes the results. Possible limitations of the treatment are discussed. (auth)

11130

CONCENTRATION OF MICROGRAM AMOUNTS OF RARE EARTHS IN THORIUM. PRECIPITATION AND ION EXCHANGE PROCEDURES. Louis Gordon, F. H. Firsching, and K. J. Shaver (Syracuse Univ., N. Y.). Anal. Chem. 28, 1476-9(1956) Sept.

Two methods have been studied for the concentration of trace rare earths (<than 100 p.p.m.) present in relatively pure Th. La^{140} and Y^{90} were used to study the efficiency of separation. A precipitation procedure was devised in which more than 98% of the La present in 1.5 grams of ThO_2 is coprecipitated with less than 1% of the latter; however, this

procedure was not effective for concentrating Y. An ion exchange procedure was also developed which was capable of concentrating both Y and La, and should be applicable to the concentration of rare earths up through Tb. (auth)

11131

PREPARATION OF RARE-EARTH CONCENTRATES. D. C. Stewart and J. P. Faris (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 3, 64-6(1956) Aug.

An ion-exchange resin column was used to recover mixed yttrium-group rare earths and it was discovered that the method was effective for separations of rare earths. The acidified glycolic acid solution of rare earths is passed through a cation-exchange resin bed from which the rare earths are then stripped in several large cuts and precipitated with NH_4OH or NaOH. The cuts varied widely in rare earth composition and the separations effected, though crude, should be useful in producing concentrates well suited for final separations and purifications. (T.R.H.)

Refer also to abstracts 11072, 11138, and 11152.

SEPARATION PROCEDURES

11132 AECD-3692

United States Phosphoric Products Div., Tennessee Corp., Tampa, Fla.

PROJECT "A" FINAL SUMMARY REPORT. G. E. Wilkinson. Jan. 4, 1954. Decl. Nov. 22, 1955. 9p. $1.80(ph OTS); $1.80(mf OTS).

11133 CRC-661

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

A BATCH PROCESS FOR THE RECOVERY OF Am^{241} FROM KILOGRAM AMOUNTS OF PLUTONIUM. J. P. Butler and J. S. Merritt. Aug. 1956. 28p. (AECL-353).

By precipitating PuO_4 from Pu solutions 1 to 2N in acid, the Am associated with the Pu can be recovered in the supernatant in about 98% yield. This procedure has been carried out with 100 to 200 g. batches of Pu. The method has the advantage that Pu is readily recovered in 99.8% yield, in a very small volume. It has the further advantage that the Pu is decontaminated from most cations so that, besides being a process for the recovery of Am, it can also be used as a final step in the purification of Pu. From 2.03 kg of plutonium processed, 0.8 g of Am^{241} have been recovered. The Am has been purified from Pu and other cations by standard precipitations and by the use of anion and cation exchange resins. The yield of Am through the purification was 98.4%. In all 770 mg of Am^{241} with a Pu content of 0.02 ppm were recovered. Spectrographic analysis of the final product showed no detectable impurities. (auth)

11134 CRDC-640

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

TRIBUTYL PHOSPHATE PROCESSING OF Pu–Al ALLOY FUELS: PRELIMINARY INVESTIGATION. P. D. Goulden, R. W. Durham, and V. Corriveau. Mar. 1955. 23p. (AECL-348).

The partition coefficients for $Pu(NO_3)_4$ between TBP and HNO_3 solutions of $Al(NO_3)_3$ have been measured. The Al has been shown to exert a considerable 'salting out' effect. The maximum Pu partition coefficient in a HNO_3 solution 0.45M. in Al is obtained when the acid is 5M. Experiments with a micro-airlift apparatus have shown that the TBP process is applicable to the treatment of Pu–Al rods by using two contactors, one for extraction and the other for backwashing the Pu. If 5% TBP is used and is almost saturated with Pu at the feed stage in contactor I, the decontamination from fission products is improved. Complete assessment of the decontamination factors obtainable cannot be made until solutions having higher activity are used. (auth)

11135 ISC-696

Ames Lab., Ames, Iowa.

LIQUID-LIQUID EXTRACTION OF MOLTEN URANIUM WITH SILVER. C. W. Watson and G. H. Beyer. Mar. 1956. 32p. Contract W-7405-eng-82.

11136 RMO-2533

Rohm and Haas Co. Research Labs., Philadelphia.

THE SOLVENT-SOLVENT EXTRACTION OF URANIUM FROM SULFURIC ACID SOLUTIONS WITH OIL SOLUBLE AMINES. Al Preuss and Jean Saunders. Apr. 14, 1955. Decl. Dec. 14, 1955. 39p. Contract AT(49-1)-535.

Fifty oil soluble amines were screened for possible use as extractants for U from H_2SO_4 solutions. The most promising of these were studied further to obtain the optimum conditions for operation of such a process. Kerosene was used as the diluent. (auth)

11137

ION DIMENSIONS AND R_F VALUES IN RADIAL PAPER CHROMATOGRAPHY. C. Bergamini and A. Rovai (Univ. of Florence, Italy). Anal. Chim. Acta 15, 43-5(1956) July.

The radial paper chromatography of some metals: Zn, Cd, Hg; Li, Na, K, Cs; Be, Mg, Ca, Sr, Ba, carried out using as mobile phase the upper layer of n-butanol–water-nitric acid mixtures of increasing acidity, shows that the phenomenon of the deepening of the color towards the external edge of the chromatogram is not to be attributed to the presence and the nature of the complex-forming agent, and that the ionic mobility does not always result in a linear function of the ionic radius. This behavior results from the interaction of various factors capable of provoking a variation of the dimensions of the solvated ion and consequently of its mobility. (auth)

11138

PAPER CHROMATOGRAPHY OF INORGANIC IONS. XIII. THE SEPARATION OF NON-COMPLEXED RARE EARTH IONS. Michael Lederer (Institut du Radium, Paris). Anal. Chim. Acta 15, 46-50(1956) July.

The sequence of the rare earth chlorides in paper chromatography with mixtures of ethanol or acetone and aqueous HCl was established. A certain number of rare earth separations is possible. (auth)

11139

DIALLYLDITHIOCARBAMIDO-HYDRAZINE AS AN ANALYTICAL REAGENT. PART II. DETERMINATION OF COPPER, ZINC, AND NICKEL IN THE PRESENCE OF IRON AND URANIUM. N. K. Dutt and K. P. Sen Sarma (Univ. Coll. of Science and Tech., Calcutta, India). Anal. Chim. Acta 15, 102-4(1956) Aug.

It has been observed that copper, zinc, and nickel can be quantitatively precipitated by diallyldithiocarbamido-hydrazine even in the presence of iron and uranium when these are present in small quantities. Chloride and nitrate ions do not interfere. Results indicate that our method is also well suited for gravimetric analysis of alloys like brass and monel metal. (auth)

11140

THE SOLUBILITIES OF SOME METAL NITRATE SALTS IN TRI-n-BUTYL PHOSPHATE. Wesley W. Wendlandt and John M. Bryant (Texas Tech., Lubbock). J. Phys. Chem. 60, 1145-6(1956) Aug.

A study of the solubilities of a series of metal nitrate salts was made in pure tri-n-butyl phosphate, to investigate other possible metal ions which may be separated by liquid-liquid extraction. (W. L. H.)

11141
MECHANICAL CONTACTORS FOR LIQUID-LIQUID EXTRACTION. Part 2. J. D. Thorton (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Eng. 1, 204-9(1956) Aug.

Constructional details are given of various types of experimental contactors which have been used at Harwell. The calculations for the diameter and height of the column-type contactors are summarized. (auth)

11142
ION EXCHANGE TECHNOLOGY. F. C. Nachod and Jack Schubert, eds. New York, Academic Press Inc., 1956. 660p.

The following subjects are discussed: ion exchange resins, equipment and process design, mass transfer and equilibria, principles of deionization with ion exchange resins, electrochemical operations, ion exclusion, economic considerations, prediction of fixed-bed performance with a computing machine, ion exchange technology in water treatment, catalysis with ion exchange resins, application in hydrometallurgy, chromium recovery from plating solutions, recovery from plating solutions, recovery of Cu from rayon wastes, the isolation in quantity of individual rare earths of high purity by ion exchange, processing radioisotopes by ion exchange, treatment of radioactive wastes, sugar refining and by-product recovery, organic chemical purification by ion exchange, and pharmaceutical and biological products. (J. E. D.)

11143
THE SEPARATION OF PLUTONIUM BY EXTRACTION WITH THENOLYTRIFLUORACETONE(TTA). J. G. Cuninghame and G. L. Miles (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg and Nuclear Chem. 3, 54-63(1956) Aug.

The separation of Pu by solvent extraction with TTA solutions is discussed. Distribution ratio data are presented together with an experimental survey of the factors affecting them. Values have been calculated for the equilibrium constant of the solvent extraction reaction for Pu^{4+}. (auth)

11144
SOUTH AFRICA: EXTRACTION PROCESS FOR GOLD–URANIUM ORES. A. M. Gaudin, R. Schuhmann, Jr., and J. Dasher. J. Metals 8, 1065-9(1956) Aug.

The application of ion-exchange to hydrometallurgy as an extraction process for Au–U ore on an industrial scale is described. (F.S.)

11145
LIQUID-LIQUID EXTRACTION PROCEDURES IN INORGANIC ANALYSIS. A REVIEW OF PRACTICAL APPLICATIONS WITH PARTICULAR REFERENCE TO METALLURGICAL ANALYSIS. T. S. West (Univ. of Birmingham, England). Metallurgia 54, 103-6(1956) Aug.

The growing complexity of modern materials has led to difficulties in their chemical analysis resulting from the increasing multiplicity of other substances accompanying the constituent to be determined. The development of new separation methods has made possible the continued use of classical analytical procedures in the face of increasing competition from physical methods. Liquid-liquid solvent extraction techniques in inorganic analysis, with particular reference to metallurgical analysis are surveyed. The extraction of the platinum metals and miscellaneous extractions are discussed. (auth)

Refer also to abstracts 11075 and 11159.

SORPTION PHENOMENA

11146 MCC-1023-TR-213
Delaware. Univ., Newark.
SORPTION STUDIES OF BORON HYDRIDES ON SOLID SURFACES (thesis). Andrew John, Jr. June 1956. 36p. For Olin Mathieson Chemical Corp. Contract NOas-52-1023-c.

Decaborane adsorption on cocoanut charcoal is monomolecular adsorption of the Langmuir type and is essentially independent of pressure. Because of condensation effects, it was impossible to obtain reliable data on the sorption of pentaborane above 20 cm. Studies made at pressures up to 20 cm indicate that adsorption is physical in nature and also of the Langmuir type. The decreasing values for the surface area of the cocoanut charcoal as determined from the sorption data for molecules of increasing size is attributed to the pore screening effect. The vapor pressure-temperature relationship of solid decaborane from 0° to the melting point follows the relationship Log P = 0.013198T – 10.577 (P in mm, T in degrees Kelvin). (auth)

11147
ANALOGY BETWEEN THE ISOTOPIC EXCHANGE IN COUNTERCURRENT FLOW AND ADSORPTION PROCESSES. A. M. Rozen. Doklady Akad. Nauk S.S.S.R. 108, 122-5(1956) May 1. (In Russian)

Calculations and diagrams are given for comparative analysis of sorption processes and the isotopic exchange in countercurrent flow. (R.V.J.)

SYNTHESES

11148
SODIUM BOROHYDRIDE REDUCTION OF ALDONIC LACTONES TO GLYCITOLS. Harriet L. Frush and Horace S. Isbell (National Bureau of Standards, Washington, D. C.). J. Am. Chem. Soc. 78, 2844-6(1956) June 20.

Two procedures are presented for the $NaBH_4$ reduction of aldonic lactones to glycitols in high yield. In the first procedure, the lactone is reduced at low temperature in aqueous solution, in the presence of sufficient buffer to maintain an acid medium during the first part of the reduction. When all of the lactone has been reduced to the sugar stage or beyond, the pH is adjusted to approximately 9, and the reaction mixture is allowed to stand overnight. Cation exchange resin HBO_3, CO_2 and $NaHC_2O_4$ were found to be satisfactory buffers. The method has been applied to the preparation of C^{14}-labeled glycitols in yields of 90 to 98%. Directions are given for the preparation of D-mannitol-2-C^{14}. In the second procedure, the lactone is treated with borohydride in anhydrous alcohol. Since the ester that may be formed by alcoholysis, like the original lactone, is reducible, the yield of the glycitol is high. (auth)

11149
A NEW METHOD FOR THE PREPARATION OF BOROHYDRIDES. A. J. King, F. A. Kanda, V. A. Russell, and Walter Katz (Syracuse Univ., N. Y.). J. Am. Chem. Soc. 78, 4176(1956) Aug. 20.

Borohydrides may be prepared by hydrolysis of MgB_2 in strong basic media. Several borohydrides were prepared by digestion of MgB_2 in various bases and it is shown that the method is simple and gives good yields. The borohydride can be isolated from solution if it is stable in the basic medium at room temperatures and is less soluble than the borate also present. (T.R.H.)

TRACER APPLICATIONS

11150
TECHNIQUES OF RADIOBIOCHEMISTRY. Sam Aronoff. Ames, Iowa State Coll. Press, 1956. 228p.

This textbook has 2 major divisions, the first dealing with theories and principles underlying the use of radioisotopes, and the second dealing with the more common com-

pounds involved in biochemical studies. Its scope is limited to general biochemical procedures commonly used in laboratories, excluding clinical and medical methods, and emphasizing the use of radiocarbon as the basis for utilization of other β-emitters. (T.R.H.)

TRANSURANIC ELEMENTS AND COMPOUNDS

11151 AERE-T/M-63

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England].

SAFETY FACTORS IN PLUTONIUM STORAGE. M. B. Biram and K. T. Spinney. [nd]. 18p.

A projected method of storing Pu is examined from the point of view of safety. The effects of concentrating Pu into separate containers and the interaction between such containers are considered together with the possibility of slowing down and reflection of neutrons in the surroundings of the storeplace. Two group diffusion theory was used in the latter investigation. It is concluded that the proposed method is quite adequate for the amounts of Pu which are required to be stored. (auth)

11152

THE LIMITING HEAT OF SOLUTION OF PLUTONIUM IN SOME RARE EARTH METALS. D. E. McKenzie, W. M. Jenkinson, and A. S. Denovan (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem. 34, 1176-81 (1956) Sept.

The distribution of plutonium between neutron-irradiated U and some rare earth metals has been examined as a function of temperature in the range 1160 to 1350°C. The results are used to calculate $\bar{L}^{\circ}_{Pu}$, the limiting partial molal heat content of plutonium, at 1250°C in La, Ce, Nd, and a commercial preparation of mixed rare earths (misch metal). The following values (in kilocalories) were obtained: lanthanum 2.9, cerium 1.1, neodymium 0.0, and misch metal 1.1. The maximum error associated with these values is ±0.4 kilocalories. (auth)

TRITIUM AND TRITIUM COMPOUNDS

11153

THE EXCHANGE OF TRITIUM BETWEEN TCl AND TOLUENE WITH AND WITHOUT CATALYST. Alan E. Comyns, Reed A. Howald, and John E. Willard (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 78, 3989-93 (1956) Aug. 20.

Mixtures of tritium-labeled HCl with toluene showed no isotopic exchange when heated at 140° for 40 hr. The addition of either NO_2 or $SnCl_4$ resulted in exchange even at room temperature. The rates at 25° appeared to be in agreement with the expression $d[TCl]/dt = -k[TCl][SnCl_4 \text{ or } NO_2]$ where k = ca. 4×10^{-4} l. moles^{-1} sec.$^{-1}$ for $SnCl_4$, and is somewhat higher for NO_2. The catalyzed exchange proceeded faster at 140°, with an apparent activation energy of 10 ± 4 kcal./mole in each case. Mixtures of tritium-labeled HCl with mesitylene at 140° gave erratic exchange, the rate in the absence of impurities always being less than 0.03% per sec. Solutions of $SnCl_4$ in toluene absorb ultraviolet light at higher wave lengths than either component alone and the spectrum is not altered by the addition of HCl. (auth)

11154

STUDIES OF THE RECOIL TRITIUM LABELING REACTION. II. METHANE AND ETHANE. Richard Wolfgang, Joseph Eigner, and F. S. Rowland (Brookhaven National Lab., Upton, N. Y.). J. Phys. Chem. 60, 1137-8(1956) Aug.

The irradiation mixtures consisted of low-temperature slurries of approximately 40 mg of Li salt and 3 mg of alkane, sealed in quartz capillaries. These tubes were irradiated for 30 to 60 sec. in a reactor at -160°C. Data on the percentages of the total activity found in each carrier for five CH_4 and one C_2H_6 runs are summarized. (W. L. H.)

11155

TRITIUM-RECOIL LABELING OF ORGANIC COMPOUNDS. F. S. Rowland (Princeton Univ., N. J.) and Richard Wolfgang (Florida State Univ., Tallahassee). Nucleonics 14, No. 8, 58-61(1956) Aug.

When a mixture of lithium salt and an organic is irradiated in a reactor, fast tritons break chemical bonds and exchange with hydrogen. A review of this labeling method is presented. (auth)

11156

MEASUREMENT OF TRITIUM AS WATER VAPOR. R. W. P. Drever and A. Moljk (Univ. of Glasgow, Scotland). Rev. Sci. Instr. 27, 650-1(1956) Aug.

Adsorption effects can introduce large errors in Geiger or proportional counter assays of tritiated water. No improvements or alternatives are offered. (T. R. H.)

Refer also to abstract 11095.

URANIUM AND URANIUM COMPOUNDS

11157 BMI-1115

Battelle Memorial Inst., Columbus, Ohio.

INVESTIGATION OF AMMONIUM URANATES. Robert A. Ewing, Samuel J.Kiehl,Jr., and Arthur E. Bearse. July 19, 1956. Decl. Aug. 20, 1956. 28p. Contract W-7405-eng-92. $4.80(ph OTS); $2.70(mf OTS).

Precipitation of aquoues UO_2 salt solutions with excess NH_4OH results in products with NH_4 : U mole ratios of approximately 0.5 : 1. This study has indicated that the theoretical ammonium diuranate, $(NH_4)_2U_2O_7$, cannot be precipitated and isolated from an aqueous system under normal conditions, even in the presence of large excesses of concentrated NH_4OH. The amorphous precipitate of a NH_4 : U ratio of approximately 0.5 : 1 loses essentially no ammonia at 105°C. Upon leaching in hot water, it hydrolyzes to a crystalline product with an NH_4 : U ratio of about 0.3:1. The x-ray-diffraction pattern of this product suggests that it may be a definite compound, possibly analogous to the $Na_2U_7O_{22}$ sodium uranate. Ammonium uranate precipitated from ammonium carbonate solution was significantly more crystalline and free filtering than that precipitated from uranyl salt solutions. (auth)

11158

AGE OF URANINITES FROM BLIND RIVER, ONTARIO. R. K. Wanless and R. J. Traill (Geological Survey of Canada, Ottawa). Nature 178, 249-50(1956) Aug. 4.

11159

AN INTERFACIAL BARRIER OBSERVED DURING LIQUID-LIQUID EXTRACTION OF URANYL NITRATE. J. B. Lewis (Atomic Energy Research Establishment, Harwell, Berks, England). Nature 178, 274-5(1956) Aug. 4.

11160

ORGANIC COMPOUNDS OF URANIUM. II. URANIUM(IV) AMIDES, ALKOXIDES AND MERCAPTIDES. R. G. Jones, G. Karmas, G. A. Martin, Jr., and H. Gilman (Iowa State Coll., Ames). J. Am. Chem. Soc. 78, 4285-6(1956) Sept. 5.

Uranium(IV) diethylamide, a green, low melting, distillable compound, was prepared from UCl_4 and $LiN(C_2H_5)_2$. Uranium(IV) ethyl and n-butylmercaptides were prepared from $U[N(C_2H_5)_2]_4$ and the corresponding mercaptans. These light green solids were pyrophoric. Uranium(IV) methoxide and ethoxide were obtained from reactions of the alcohols with $U[N(C_2H_5)_2]_4$. They were light green solids, readily decomposed by air or moisture. (auth)

11161
ORGANIC COMPOUNDS OF URANIUM. III. URANIUM(V) ETHOXIDE. R. G. Jones, E. Bindschadler, G. Karmas, F. A. Yoeman, and H. Gilman (Iowa State Coll., Ames). J. Am. Chem. Soc. 78, 4287-8(1956) Sept. 5.

Uranium(IV) ethoxide, a dark-brown, thermally stable, distillable liquid, was prepared by several methods. Its physical properties and some of its reactions are described. (auth)

11162
ORGANIC COMPOUNDS OF URANIUM. IV. URANIUM(V) ALKOXIDES. R. G. Jones, E. Bindschadler, G. Karmas, G. A. Martin, Jr., J. R. Thirtle, F. A. Yoeman, and H. Gilman (Iowa State Coll., Ames). J. Am. Chem. Soc. 78, 4289-90(1956) Sept. 5.

A number of U^{5+} alkoxides were prepared by several methods, the most important of which was the exchange reaction $U(OC_2H_5)_5 + 5ROH \rightarrow U(OR)_5 + 5C_2H_5OH$. (auth)

Refer also to abstracts 11088, 11089, and 11585.

ENGINEERING

HEAT TRANSFER AND FLUID FLOW

11163 CF-55-12-118
Oak Ridge National Lab., Tenn.
TRANSPORT OF GASES THROUGH LIQUID–GAS MIXTURES. R. V. Bailey, P. C. Zmola, F. M. Taylor, and R. J. Planchet. Dec. 21, 1955. 36p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

The designs and analyses of many operations involving interaction between liquid and gaseous systems (e.g., fractionating towers, evaporators, steam generators, boiling nuclear reactors, etc.) suffer from a lack of information of the gas throughput versus gas hold-up in the system. For the gas throughput versus gas hold-up in vertical pipes the following data and analyses are presented: Experimental data in non-circulating systems to show the effect of pipe size and the effect of the physical properties of the gas and liquid; experimental data in non-circulating systems for the average fluctuation of the gas hold-up; experimental data of the radial gas distribution; an analytical model for the prediction of gas throughput versus gas hold-up in circulating systems (both gas and liquid flowing through the pipe); and an experimental confirmation of the utility of an analytical model. (auth)

11164 HW-41174
[Hanford Atomic Products Operation, Richland, Wash.].
MODIFICATION OF A 1706-KER LOOP FOR BOILING. F. E. Tippets. Feb. 7, 1956. 14p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The 1706 KER Recirculation Loops were constructed in order to provide a facility for obtaining experimental data on the operating characteristics, heat transfer, and corrosion and erosion effects in a recirculating in-pile loop under various conditions of water coolant properties and fuel element types. The system was designed to be cooled by water in the liquid phase, but was to be capable of being later converted in part to allow in-pile boiling experiments to proceed. (auth)

11165 WAPD-T-302
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF SURFACE TEMPERATURES OF CARTRIDGE-TYPE ELECTRIC HEATERS OPERATING IN CLOSE-FITTING ENCLOSING HEATER WELLS. R. L. Williams. June 6, 1956. 76p. $12.30(ph OTS); $4.50(mf OTS).

The effects of wattage density and radial clearance on surface temperatures of the cartridge-type heaters were investigated. These heaters are used to generate and maintain the steam volume within the pressurizing vessels of the PWR power plants. (C.W.H.)

11166 RAE-Trans-530
SOME PROBLEMS IN THE HYDRODYNAMIC THEORY OF HEAT TRANSFER IN THE FLOW OF AN INCOMPRESSIBLE LIQUID. (Nekotorye Voprosy Gidrodinamicheskoi Teorii Teploobmena Pri Techenii Neszhimaemoi Zhidkosti). V. M. Ievlev. Translated by M. Goyer from Doklady Akad. Nauk S.S.S.R. 86, 1077-80 (1952). 7p. (AD-72454)

A method is described for using the experimental values of friction and heat transfer for a body of one form in a flow of incompressible liquid to calculate the results for bodies of different geometrical form, certain limiting conditions being imposed. (auth)

11167
1956 HEAT TRANSFER AND FLUID MECHANICS INSTITUTE, HELD AT STANFORD UNIVERSITY, STANFORD, CALIFORNIA, JUNE 21, 22, 23, 1956. Preprints of Papers. Stanford, Stanford Univ. Press, 1956. 278p. $5.75.

Seventeen papers selected because of their fundamental character and their broad implications in heat transfer and fluid mechanics are presented. (F.S.)

11168
AVERAGE AND LOCAL HEAT TRANSFER FOR CROSS FLOW THROUGH A TUBE BANK. R. A. DeBortoli, R. E. Grimble, and J. E. Zerbe (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 1, 239-51(1956) July.

Heat transfer coefficients have been determined for a cross flow tube bank by heat and mass transfer techniques for the Reynolds number range of 35,000 to 80,000. Average heat transfer coefficients agree favorably with extrapolations of existing data. Local coefficient variations from the average were as great as +80% and –55%. (auth)

Refer also to abstracts 11106 and 11501.

MATERIALS TESTING

11169 NAVORD-3649
Naval Ordnance Lab., White Oak, Md.
HANDBOOK OF INDUSTRIAL RADIOLOGY. J. J. Hirschfield, N. Modine, D. T. O'Connor, E. L. Criscuolo, and D. Polansky. June 30, 1954. 157p.

A general review of industrial radiology is given along with a discussion of the various factors affecting radiographic quality. Gamma ray techniques are discussed, as well as x-ray procedures. A comprehensive compilation of data in tabular and graphic form is included, to serve as a ready reference for radiology and related types of material evaluation. (auth)

11170
A NON-DESTRUCTIVE MICROCHEMICAL METHOD OF SORTING STEELS. W. R. Nall and R. Scholey (Naval Ordnance Inspection Dept., Sheffield, England). Metallurgia 54, 97-102(1956) Aug.

A microchemical procedure is described for the rapid sorting of carbon and low alloy steels which uses simple, inexpensive apparatus. The classification of unknown steels is based on the estimation of manganese, nickel, chromium and molybdenum. A small number of analyzed steels are used as standards for comparison purposes. The portable apparatus is self-contained and non-destructive in use, and may be applied to field work. (auth)

PUMPS

11171 AERE-ED/R-1856
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A.C. LIQUID METAL PUMPS FOR LABORATORY USE. D. A. Watt. Mar. 19, 1953. Revised Jan. 24, 1956. 33p.

Two types of single phase a-c electromagnetic pump for liquid metals are described, a leakage reactance model and a combined pump and transformer. The NaK alloy test rig is briefly described and methods of pump construction detailed. Test results and curves for pumping NaK alloy at temperatures below 70°C are included, and it is shown that the combined form is the more effective pump. One of these models with a single loop secondary winding had a maximum efficiency of 11% with output 10 gals/min. at 13 lb/in.^{2} pressure rise, input 650 watts, 9.0/7.5 amps at 180/195 volts. A maximum pressure rise of nearly 30 lb/in.^{2} is recorded for the first model of this form. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

11172 AD-71936
American Electro Metal Corp., Yonkers, N. Y.
CEMENTED BORIDES. Summary Progress Report for the Period June 1, 1954 to July 31, 1955. Ira Binder and David Moskowitz. 139p. Contract N6-ONR-256.

A new high temperature material, Borolite IV, has been found. This material, comprising several compositions of the type Cr_2B + Cr-Mo alloy, has outstanding characteristics in heat shock resistance, oxidation resistance and stress-to-rupture strength through 2000°F. Impact strength of Borolite IV as such is not yet good enough for most desired uses, but coating experiments have given promise that this can be improved considerably. Such an improvement, without too great a sacrifice of the other desirable high temperature properties, would make Borolite IV a most desirable and useful high temperature material. (auth)

11173
AN IMPACT TEST FOR USE WITH CERMETS. Edwin J. Soxman, James R. Tinklepaugh, and Martin T. Curran (State Univ. of New York, Alfred). J. Am. Ceram. Soc. 39, 261-5(1956) Aug.

Several specimens of a commercially produced nickel-bonded titanium carbide cermet were tested in eight laboratories at room temperature and at 1800°F. by an increment-type impact test in which the specimens were held as a cantilever in a vise and were subjected to repeated blows of increasing intensity at their free ends. The inconsistent results obtained were attributed to differences in (1) vise jaw insert material and design, (2) vise gripping pressure, or (3) the stress condition of the specimen at elevated temperatures as contrasted with that at room temperature. A different increment-type impact test was developed and was used for evaluating the low-velocity impact behavior of cermets as a function of temperature. In this test the specimens were supported at their ends and were subjected to impact loading at their midpoints by a freely falling hammer. Hot tests were conducted on specimens heated by means of their electrical resistance. The test was modified, by the addition of a miniature muffle furnace, for testing electrical insulators at elevated temperatures. It was established that increment impact tests, when used with metal-bonded cermets, are subject to a repeated-blow effect; i.e., low-energy blows contribute not only to recoverable elastic deformation but also to some permanent damage. In spite of this complication, the new test has been tentatively accepted for use by several cermet research laboratories. (auth)

11174
GASEOUS OXIDES AND ALUMINUM, TUNGSTEN, AND TANTALUM. R. J. Ackermann and R. J. Thorn (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 78, 4169 (1956) Aug. 20.

The results of studies on the effusion of Al_2O_3 and W at 2587°K indicate that a reation of this type occurs: $Al_2O_3(l) + ((3-2x)/Y)W(s) \rightarrow 2\ AlO_x(g) + (3-2x)/Y)WO_y(g)$, contradicting previous reports by others. More detailed experiments are needed to establish the nature of the products. The reaction of Al_2O_3 in a tantalum effusion cell is more easily understood and appears to be as follows: $Al_2O_3(s) + 3/x\ Ta(s) \xrightarrow{1700^\circ} 3/x\ TaO_x(S) + 2\ Al(g) + y\ Ta(s) \xrightarrow{2250^\circ} (3/x + y)\ TaO(g)$. (T.R.H.)

11175
A HIGH TEMPERATURE PROPANE–OXYGEN FURNACE. Richard C. Phoenix, Donald R. Robinson, and Edwin Ruh (Rutgers Univ., New Brunswick, N. J.). Am. Ceram. Soc. Bull. 35, 303-4(1956) Aug.

A high temperature furnace has been designed and constructed to fire refractory oxide samples to temperatures above 3500°F. The kiln is fired with propane and oxygen, using water-cooled burners. Stabilized zirconia refractories were used in the construction of the firing chamber. Pictures and specifications are presented. (auth)

11176
INFILTRATION OF TiC SKELETONS. Herman Blumenthal (American Electro Metal Div., Firth Sterling Inc., Yonkers, N. Y.) and Ronald Silverman (Sylvania Electric Products Inc., Bayside, N. Y.). J. Metals 8, 977-81(1956) Aug.

Infiltrability of a porous TiC compact, producted by powder metallurgy technique, depends on the capillarity of the compact and the surface condition and nature of the individual particles. Capillary forces raise the liquid metal infiltrant into the interconnected pores of the compact and the complete filling of these pores is a function of their geometry as well as the wettability of the TiC particles. The paper deals especially with the improvement of this wettability through surface conditioning of the TiC particles. (auth)

CORROSION

11177 AECU-3318
Case Inst. of Tech., Cleveland.
AN INVESTIGATION OF SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES. Quarterly Status Report No. 13 [for] June 2, 1956 to September 2, 1956. E. B. Evans and W. M. Baldwin, Jr. Sept. 10, 1956. 7p. Contract AT(11-1)-258. $1.80(ph); $1.80(mf OTS).

The structure of the scales formed on Zr heated in various atmospheres is shown schematically. The composition of various scale layers was determined by means of x rays, employing both powder samples for the total scale conglomerate and glancing x rays of the scale surface before and after grinding off the outer portions of the scale. X-ray results are tabulated. (auth)

11178 ATI-204861
Quartermaster Research and Development Labs., Philadelphia.
CONTAINER COATINGS. Bibliographic Series No. 12. Francis D. Horigan and Cary R. Sage. Mar. 1950. 46p.

A bibliography is given of abstracts from journals and patents on container coatings. Included are abstracts on

manufacturing processes for coatings and linings of many types, their uses, advantages, disadvantages and standards for use as food containers. (T.R.H.)

11179 NRL-4798

Naval Research Lab., Washington, D. C.

OPERATION OF NRL-1 CARBON STEEL LOOP AT THE MATERIALS TEST REACTOR. Final Report. V. J. Linnenbom, G. E. MacVeigh, H. S. Dreyer, and G. M. Dinnick. June 26, 1956. 29p. Project Nos. NR-665-040 and NS-200-023.

The effects which might be encountered in the operation of a pressurized water reactor whose primary coolant system is constructed of carbon steel were investigated using a carbon steel loop. In this loop water at 600°F and 2200 psi could be circulated at velocities up to 30 ft/sec past fuel element assemblies and corrosion specimens in two thimbles, one located in-pile and the other out-of-pile. Remotely operated valves allowed part of the circulating water to be bypassed through a sample station where water samples could be removed for analysis of conductivity, pH, gas content, and activity. In addition part of the water from this bypass was fed through a crud filter and through various ion exchangers for purposes of purification, monitoring activity, determining crud levels, etc. The total flow rate as well as the individual flow rates past the fuel elements and corrosion specimens could be measured by means of Foxboro differential pressure cells connected across calibrated Foster flow elements. The in-pile test run at the MTR covered a total of 79 days of operation at a water temperature of 575 to 600°F and a system pressure of 2200 psi. Of this period, 63 days were accumulated with the reactor at full power; the remaining time was accumulated during reactor shutdown periods. From the standpoint of deposition of corrosion products on exposed fuel element surfaces, water purification data, and the accessibility as determined by the various radioactive species within the system, carbon steel appears to suffer no serious disadvantages when compared to stainless steel. From weight changes of the corrosion specimens, there appears to be no increase in corrosion due to radiation. The feasibility of replacing stainless steel with carbon steel in pressurized water reactor systems will therefore depend on other factors not investigated in this experiment, e.g., stress corrosion and hydrogen embrittlement effects. (auth)

11180 WAPD-T-382

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

THE EFFECT OF PRE-OXIDATION IN OXYGEN ON THE STEAM CORROSION BEHAVIOR OF ZIRCALOY-2. D. E. Thomas and S. Kass. June 13, 1956. 13p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

The effect of pre-oxidation in dry O_2 upon the corrosion behavior of Zircaloy-2 and unalloyed Zr in steam was investigated. In the case of Zircaloy-2 pre-oxidation has no effect upon corrosion behavior, the kinetics being the same whether all or part of the total exposure is in O_2. A transition in kinetics from quasi-cubic to linear occurs in the corrosion of Zircaloy-2 in either medium, indicating that the transition is not associated with corrosion product H_2. On the other hand, unalloyed Zr shows neither transition nor breakaway (spalling) when exposed to O_2, and exhibits breakaway on exposure to steam whether pre-oxidized or not, suggesting that breakaway is associated with corrosion product H_2. The phenomena of breakaway and transition are shown to be distinctly different. (auth)

11181

THE EFFECTS OF CONTAMINATION BY VANADIUM AND SODIUM COMPOUNDS ON THE AIR-CORROSION OF STAINLESS STEEL. G. W. Cunningham and Anton deS. Brasunas (Univ. of Tennessee, Knoxville). Corrosion 12, 389t-405t(1956) Aug.

The acceleration of high temperature corrosive attack on heat-resistance alloys caused by the presence of V compounds is well established. The progressive addition of sodium sulfate to the V contaminant indicates that the most corrosive mixture is approximately 20% sodium sulfate–80% vanadium pentoxide. The survey of the melting temperatures of various vanadium pentoxide–sodium sulfate mixtures shows no direct correlation to corrosive behavior. There appears to be a strong indication, however, that unusually high oxygen solubility in the molten contaminant containing 20% sodium sulfate may be responsible for its unusually high corrosiveness. This makes it possible to postulate a more satisfactory theory of the mechanism of corrosive attack which need not involve a solid phase at the reaction interface. Additions of calcium oxide, strontium oxide, and carbon were particularly effective in reducing the intensity of attack. The effectiveness of carbon is restricted to short time intervals during which it became oxidized. (auth)

11182

THE ROLE OF CREVICES IN DECREASING THE PASSIVITY OF TITANIUM IN CERTAIN SOLUTIONS. David Schlain and Charles B. Kenahan (U. S. Bureau of Mines, College Park, Md.). Corrosion 12, 422t-6t(1956) Aug.

Crevices increase the tendency of titanium to corrode in certain solutions in which it normally is made passive by air. This increase in the corrosion rate occurs most consistently in air-saturated 1N sulfuric and 1.6 to 1.75N hydrochloric acid solutions. Corrosion is not confined to crevices but appears to be uniform over the entire surface. An explanation is presented. (auth)

11183

AQUEOUS CORROSION OF ALUMINUM. PART 1. BEHAVIOR OF 1100 ALLOY. J. E. Draley and W. E. Ruther (Argonne National Lab., Lemont, Ill.). Corrosion 12, 441t-8t(1956) Sept.

Aluminum alloy 1100 corrodes uniformly in nearly pure water at rates which increase with temperature. The reaction is characterized by an initial period of relatively rapid corrosion, followed by a constant lower rate of corrosion. The slope of the linear part of the curve or the "corrosion rate" changes from about 0.02 to 2.5 mg/dm^2-day (.01 to 1.3 mil/yr) from 50 to 200°C. Above 200°C intergranular attack occurs, with resultant more rapid penetration and deterioration of the metal. The corrosion rate can be reduced by the addition of an acid to the water. The solution pH of minimum corrosive attack on aluminum goes down with increasing temperature. It is of the order of 6.5 at 50°C and 3 at 300°C. Corrosion in slightly alkaline solutions (pH 8.5) is more rapid than in neutral water at all temperatures. At 100°C the difference shown in stagnant tests is very slight, but increases considerably if the temperature is increased to the order of 200°C. Presumably the effect of solution flow rate would be greater in the case of alkaline water than in neutral water. At 200°C the addition of dichromate ion increased the rate of corrosion. A small concentration of sodium silicate resulted in a higher corrosion rate at pH 9.4, while at pH 3.5 it reduced the rate significantly. Chloride ion (5 ppm) caused some pitting and increased the corrosion rate slightly. Electrical coupling to more cathodic materials, such as graphite, zirconium or stainless steel produced no undesirable effects in distilled water at 200°C. At 315°C, the corrosion life of samples was extended by such coupling. (auth)

11184

THE RELATION OF THIN FILMS TO CORROSION. Thor N. Rhodin. Corrosion 12, 465t-75t(1956) Sept.

Recent studies of thin oxide films isolated from stainless steels and other ferrous alloys have provided new information on surface properties. Correlations between the unique compositional and structural properties of thin films and alloy corrosion behavior in various corrosive environments have been established. Evaluation of the resistance to pitting corrosion of silicon-modified Type 316L stainless steel is described as a typical example of an application of a film study to corrosion research. In this case, improved corrosion behavior was correlated with a mutual film-enrichment of silicon and molybdenum and a film-depletion of iron. Experimental alloys of improved purity were prepared and evaluated. Effects of alloy purity, carbon content, and alloying additions were found to influence strongly surface behavior and corrosion resistance. The mechanism of resistance to pitting corrosion and the protective nature of the associated oxide films are interpreted in terms of the chemistry of hydrated heteropoly acids containing oxides of silicon and molybdenum. (auth)

11185

THE MECHANISM OF THE INHIBITION OF CORROSION BY THE PERTECHNETATE ION. IV. COMPARISON WITH OTHER XO_4^{n-} INHIBITORS. R. F. Sympson and G. H. Cartledge (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 60, 1037-43(1956) Aug.

The effect of the addition of electrolytes on the potential of iron electrodes immersed in solutions of four inhibitors — CrO_4^{2-}, TcO_4^-, MoO_4^{2-}, WO_4^{2-} — has been determined at 57.5°. The behavior of the electrode potentials confirms the previous conclusion that a labile state exists at the metal-solution interface, and that the mechanism of corrosion inhibition is reversible with respect to addition or removal of electrolyte. All four inhibitors maintained the iron electrodes at potentials more noble than the Flade potential in the presence of dissolved air, but only the pertechnetate ion did so in deaerated solutions. In deaerated solutions of MoO_4^{2-} and WO_4^{2-}, the iron electrode potentials were essentially the same as in sodium sulfate. The potentials in deaerated CrO_4^{2-} solution were 200 mv. or more less noble than in TcO_4^-, but still considerably more positive than the potentials in solutions of MoO_4^{2-} or WO_4^{2-}. Addition of chloride or thiocyanate ions initially produced an ennobling of the potentials, up to the concentration at which final debasing set in. The bearing of the results on the theory of inhibition and electrode potentials is discussed. (auth)

11186

HIGH TEMPERATURE SCALING OF COBALT–CHROMIUM ALLOYS. C. A. Phalnikar, E. B. Evans, and W. M. Baldwin, Jr. (Case Inst. of Tech., Cleveland). J. Electrochem. Soc. 103, 429-38(1956) Aug.

Scaling rates and scale compositions of Co–Cr alloys were determined in the temperature range 900 to 1200°C. At any given temperature the scaling rate increased with low Cr additions, then dropped precipitously with further additions reaching a minimum at about 25% Cr. Thereafter the scaling rate again increased approaching the scaling rate of Cr as the upper limit Above a critical concentration of about 25% Cr, the scale consisted exclusively of Cr_2O_3. Below this critical concentration, complex scales consisting of the oxides of both Co and Cr were formed. The best scaling resistance was associated with a scale consisting predominantly of Cr_2O_3, not spinel. Schematic isothermal sections of the deduced Co–Cr–O phase diagram were applied as an aid in interpreting the scaling behavior. (auth)

11187

THE STRESS-CORROSION OF CERTAIN ALUMINIUM ALLOYS. H. K. Farmery and U. R. Evans (Cambridge Univ., England). J. Inst. Metals 84, 413-22(1956) July.

Stress-corrosion cracking of sheet material in salt-solution is favored by removal of the as-rolled film from Al–7% Mg alloy in $AlCl_3$ solution or of that from Al–4% Cu in NaOH solution, and by addition $NaHCO_3$ to the salt solution, which prevents the weak anodic acidity being swamped by the strong cathodic alkalinity; the stress-corrosion life is greatly affected by previous heat-treatment. If the exposed area is made small, life is usually increased, but electrical connection to a large unstressed area may shorten the life of the 7% Mg alloy; the current flowing in a "differential stress cell" between a stressed 7% Mg alloy specimen as anode and an unstressed one as cathode, increases with the magnitude of the stress applied. Junction of the small stressed alloy specimen to a noble metal such as Cu greatly shortens the life; junction to steel or stainless steel produces a similar result on the 7% Mg alloy, rusty steel being a more effective cathode than abraded steel. Junction to Zn or Al produces an effect which varies with the alloy and its previous heat-treatment, but Zn can prolong the life of Al–7% Mg alloy in some circumstances. The absence of conspicuous corrosion product and the bright fracture suggest that the total amount of chemical action is not large, but chemical change affecting only a small amount of intergranular matter may suffice to replace plastic deformation within the grains by intergranular rupture. (auth)

Refer also to abstract 11174.

GEOLOGY AND MINERALOGY

11188 AECU-3266

Columbia Univ., New York. Lamont Geological Observatory.

VARIATIONS IN THE ISOTOPIC COMPOSITION OF COMMON LEAD AND THE HISTORY OF THE CRUST OF THE EARTH (thesis). George L. Bate and J. Laurence Kulp. June 1955. 130p. Contract AT(30-1)-1114. $19.80(ph OTS); $6.30(mf OTS).

The present work was undertaken with the purpose of conducting a reconnaissance of common Pb minerals of world-wide distribution to add to the growing fund of Pb isotopic abundance data, and to catalog in more detail the variations in isotopic composition of common Pb in the U.S. The data obtained provide the basis for a number of theoretical conclusions. New limits on the possible variations in isotopic composition in various geologic settings can be defined. This makes it possible to identify anomalous leads with greater certainty. A revised model of crustal differentiation can be proposed. The age of the earth's crust can be reassessed. The relative abundances of U and Th to Pb in the earth's crust can be reevaluated. It is possible to limit the speculation on the mechanism and origin of Pb-ore formation. In summary, the acquisition of new common Pb isotopic data permits further study of the history of the earth's crust, both in the broader aspects of crustal formation and composition, and in the local aspects of mineral formation throughout geologic time at various differentiating foci. (auth)

11189 RME-86

Grand Junction Operations Office. Exploration Div., AEC.

URANIUM OCCURRENCES IN THE AMBROSIA LAKE AREA, McKINLEY COUNTY, NEW MEXICO. Robert G. Young and Gene K. Ealy. Mar. 1956. 15p., 2 illus. $0.20(OTS).

Uranium was discovered in Ambrosia Lake Area in April, 1955, and extensive exploration drilling followed. The area is rimmed on the north by high cliffs of the Mesaverde formation, and drilling was largely confined to the broad strike valley developed on Mancos shale and the

dip slope of the underlying Dakota formation. This valley is bounded on the south by the Dakota escarpment, and the underlying Morrison and Bluff formations crop out in the steep south face of that escarpment. Surface elevations range from about 6,750 to 7,650 ft. The uranium deposit first discovered was apparently related to geologic structure, and in August, 1955, the AEC began preparation of structural and surface geologic maps in order to test the hypothesis of structural control. Aerial photographs were used as the base for surface geologic mapping. The structure contour map is based on drill hole data and elevation control on key horizons by alidade and altimeter. Gamma-ray logging of hundreds of drill holes, by the AEC, was useful in correlating formations and developing structural and ore reserve information. (auth)

11190 RME-3127

Bureau of Mines.

HOLLOW CREEK MONAZITE PLACER, AIKEN COUNTY, SOUTH CAROLINA. M. H. Kline, R. F. Griffith, and L. A. Hansen. Mar. 1954. 29p.

An exploratory churn-drilling program to determine the tenor and extent of the Hollow Creek monazite deposit was approved and initiated in December 1951. Results from 21 holes selected to outline the reserve area indicate that on Hollow Creek and its tributary Town Creek there are 66,385,000 yd^3 of minable alluvium containing heavy minerals. This deposit also contains 259 lb/yd^3 of plus $\frac{1}{8}$-in. material, which might be marketed as road aggregate or construction material. (auth)

11191

URANIUM DEPOSITS AT BASE OF THE SHINARUMP CONGLOMERATE, MONUMENT VALLEY, ARIZONA. I. J. Witkind. U. S. Geol. Survey Bull. 1030-C, 99-130(1956). $0.65(GPO)

Exposed sedimentary rocks on the Navajo Indian Reservation in Apache and Navajo Counties, northeastern Arizona, range from the Halgaito tongue of the Cutler formation (Permian) to the Salt Wash member of the Morrison formation (Jurassic). The dominant structural element of the area is the Monument upwarp, a large asymmetrical anticline whose northern end is near the junction of the Green and Colorado Rivers in Utah and whose southern end disappears near Kayenta, Ariz. Asymmetrical anticlines with steeply dipping east flanks and gently dipping west flanks are superimposed on the upwarp. These subsidiary structures trend northward. The uranium-ore bodies are localized in conglomeratic sandstone of the Upper Triassic Shinarump conglomerate that fills stream channels scoured in the underlying Lower and Middle Triassic Moenkopi formation. These channels range from narrow and shallow, 15 ft. wide and 10 ft. deep, to broad and deep, 2,300 ft. wide and 70 ft. deep. Two types of channels can be distinguished—a short type, less than 2 miles long, and a long type, traceable for distances greater than 2 miles. Plant matter in the form of trees, branches, and twigs was deposited with Shinarump sediments in the channels. It is probable that when the Shinarump conglomerate was invaded by mineralizing solutions the uranium ore was deposited primarily in localities formerly occupied by the plant material. Also, it is thought that the short channels are more likely to have ore accumulations than long channels. (auth)

11192

ACCURACY OF ORE-RESERVE ESTIMATES FOR URANIUM–VANADIUM DEPOSITS ON THE COLORADO PLATEAU. A. L. Bush and H. K. Stager. U. S. Geol. Survey Bull. 1030-D, 131-48(1956). $0.45(GPO)

The U. S. Geological Survey has made estimates of the reserves of uranium and vanadium in the carnotite deposits explored by Geological Survey drilling on the Colorado Plateau. This report presents an appraisal of the accuracy of the reserve estimates for carnotite deposits in the Uravan mineral belt, the causes of inaccuracy, and the significance of the estimates in terms of the total known reserves of the region. (auth)

11193

THE OCCURRENCE OF MINOR ELEMENTS IN ASH OF LOW-RANK COAL FROM TEXAS, COLORADO, NORTH DAKOTA, AND SOUTH DAKOTA. Maurice Deul and C. S. Annell. U. S. Geol. Survey Bull. 1036-H, 155-72 (1956). $0.25(GPO)

The distribution of 27 minor elements in the ash of 319 samples of low-rank coal from five localities was studied to determine whether any elements were correlated with uranium in the coal and also whether any elements occurred in amounts large enough to be of commercial importance. The coal samples were ashed in a muffle furnace at 800°C, and semiquantitative spectrographic analyses were made of six channel samples to establish analytical control on ash of this type. The uranium was determined chemically by a fluorimetric method. None of the coal shows any general enrichment of minor elements over coal from any other area. Boron, barium, and strontium are enriched in all the ash samples analyzed. A correlation between uranium and molybdenum exists only for the coal from the Dakotas where enrichment from ground water has been postulated. No other correlation is apparent. Sufficient data for 18 minor elements permits a graphic comparison of the coal from the five localities. Histograms show high concentrations of tin, copper, zirconium, boron, barium, and strontium in the coal from Milam County, Tex. (auth)

11194

RADIOACTIVE TRACER TECHNIQUES FOR SAND AND SILT MOVEMENTS UNDER WATER. J. L. Putman and D. B. Smith (Atomic Energy Research Establishment, Harwell, Berks, England). Intern. J. Appl. Radiation and Isotopes 1, 24-32(1956) July.

The choice of powdered glass, containing Sc^{46} as a physical tracer for following the underwater movement of sand and silt, is discussed. Two experiments are described to show its application to the study of river siltation and of the offshore movement of sand on the sea-bed. The results obtained give information about the amount of radioactivity required in such experiments, and methods of depositing it and tracing its movement. (auth)

11195

METHODS OF URANIUM PROSPECTING. V. G. Melkov. Soviet J. Atomic Energy, No. 1, 85-91(1956).

The various methods of surveying an area for U deposits are briefly reviewed. (B. J. H.)

Refer also to abstract 11158.

METALS AND METALLURGY

11196 BMI-1092

Battelle Memorial Inst., Columbus, Ohio.

THE STABILITY AND EXISTENCE RANGE OF THE ZIRCONIUM–URANIUM EPSILON PHASE. Frank A. Rough, Alfred E. Austin, Arthur A. Bauer, and J. Robert Doig. May 28, 1956. Decl. July 5, 1956. 36p. Contract W-7405-eng-92. $6.30(ph OTS); $3.00(mf OTS).

Data which show the intermediate Zr–U epsilon phase to be a thermodynamically stable phase are presented and the Zr–U constitutional diagram is shown. The effect of O_2 and N_2 on Zr–U alloys, and on epsilon-phase alloys in particular, is shown. Ternary Zr–U–O diagrams are presented. A two-phase beta Zr-plus-epsilon region extends from about 44 to 57 or 58 wt. % U. The solubility limits of

the epsilon region narrow with decreasing temperature. At 550°C these limits are estimated to be about 45 and 53 wt. % U. Isotherm temperatures on either side of the epsilon phase show a difference of 14°C. Thermal-analysis data, which are believed the most reliable data obtained in indicating absolute temperatures, show these temperatures to be 593 and 607°C on the Zr- and U-rich sides of the epsilon phase, respectively. Less than 500 ppm O is soluble in the epsilon phase. Maximum solubility occurs at some composition between 50 and 55 wt. % U. A change in rate of thermal expansion of the epsilon phase at low temperatures suggests the possibility of some structural change. The nature of this change is unknown. (auth)

11197 ORNL-2122

Oak Ridge National Lab., Tenn.

IMPACT BEHAVIOR OF THORIUM. J. A. Milko. Sept. 20, 1956. 21p. Contract W-7405-eng-26. $0.20(OTS).

Impact properties were determined on high-purity Th, bomb-reduced Th, and pure Th–C alloys. Pure Th retains its toughness at subzero temperatures similarly as the other face-centered cubic metals, Cu, Ni, Al, and Pb. An addition of carbon to pure Th results in the presence of a transition temperature in the metal. Bomb-reduced Th exhibits a ductile to brittle transition temperature. This transition temperature can be shifted slightly by the impact testing conditions. Apparently, the transition temperature of bomb-reduced Th results from the presence of impurities in the metal. No indication could be obtained that the aging treatments used, embrittled bomb-reduced Th in impact. Trends were obtained which suggest that hydrogen may embrittle bomb-reduced Th at low temperatures. (auth)

11198 RRE-TN-555

Gt. Brit. Radar Research Establishment, Malvern, Worcs, England.

THE DEPOSITION OF ALUMINIUM FROM NON-AQUEOUS ELECTROLYTES. R. J. Heritage. July 1955. 30p. (AD-79802).

Aluminum can be deposited from three non-aqueous electrolytes at room temperature: the hydride type of solution appears most suitable. Although the throwing power is poor compared with conventional Cu and Ag electrolytes, the Al deposits are coherent, ductile and of high purity. Significant benefits are derived from the use of addition agents and by periodic current reversal. The rate of deposition is slow but it is likely that the hydride solution could be economically operated when adequate precautions are maintained to exclude water. (auth)

11199 TML-50

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE SELECTION OF MATERIALS FOR HIGH-TEMPERATURE APPLICATIONS IN AIRCRAFT GAS TURBINES. Aug. 17, 1956. 34p. For Battelle Memorial Inst. Titanium Metallurgical Lab. Contract AF18(600)-1375, Subcontract No. 2.

A survey was made of the major gas-turbine manufacturers to determine the applicability of Ti in gas turbines and the criteria whereby gas turbine materials are selected. The ultimate tensile strength, yield strength, stress-rupture properties, and fatigue strength of three commercial Ti alloys and one experimental alloy are compared on a strength/density basis with similar properties for other metals. Other properties considered are modulus of elasticity, damping capacity, creep strength, corrosion resistance, weldability, thermal stability, and notch sensitivity. The temperature range for superior performance of titanium over other metals is identified. A discussion is given on the current applications of Ti in gas turbines and the possible influence of future trends in gas-turbine development. (auth)

11200 TML-52

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

TITANIUM SPONGE PRODUCTION METHODS AND PRESENT STATUS. J. L. Gissy, G. H. Schippereit, and J. G. Kura. Sept. 7, 1956. 30p. Contract AF18(600)-1375.

In a review of the manufacture of titanium sponge, emphasis is placed on those areas where improvements may be made in the production technology of titanium sponge. The raw materials used in the manufacture of Ti sponge are discussed at length. The advantages and disadvantages of the different Ti ores are reviewed. Particular emphasis is placed on the use of ilmenite instead of rutile. Chlorination of rutile and ilmenite to produce Ti tetrachloride, purification of Ti tetrachloride, and the reduction of Ti tetrachloride to Ti sponge are covered. The merits and shortcomings of the Kroll process and of the Na process are pointed out. Listed also are the industrial organizations, both domestic and foreign, which produce Ti sponge. (auth)

11201 WADC-TR-56-170

Rensselaer Polytechnic Inst., Troy, N. Y.

METALLOGRAPHY OF ALUMINUM POWDER EXTRUSIONS. F. V. Lenel, E. C. Nelson, G. S. Ansell, and M. V. Rose. July 1956. 64p. Project title: METALLIC MATERIALS. Task title: THE EFFECT OF COMPOSITION AND INTERNAL STRUCTURE ON THE PROPERTIES OF ALLOYS. Contract AF33(616)-351, Report No. 2. (AD-97155).

Determinations of the specific surface of flake Al powders used in the production of experimental aluminum powder extrusions have shown that the surface of the flake powder particles is not smooth but has many cracks and irregularities. Using the carbon film replica technique, high resolution electron micrographs were prepared of aluminum powder extrusions, both of those prepared experimentally in the laboratory and of those produced commercially. The structure of the experimental extrusions exhibits thin platelets of aluminum oxide, approximately 100 A units thick, with the number of platelets present proportional to the oxide content. In the production of commercial extrusions these platelets are spheroidised. Their structure shows oxide particles of approximately equal length and width in a wide range of sizes. The behavior of Al powder extrusions during cold working and annealing changes with the degree of dispersion of the oxide particles. The finer the dispersion, the larger is the critical amount of cold work and the higher is the annealing temperature necessary to induce recrystallization and grain growth. Extrusions from flake Al powder, even those from a relatively coarse flake powder, have to be cold worked and annealed near the melting point repeatedly in order to obtain grain growth. (auth)

11202

DENSITY CHANGES DURING THE ANNEALING OF DEFORMED NICKEL. L. M. Clarebrough, M. E. Hargreaves, and G. W. West (Univ. of Melbourne, Australia). Phil. Mag. (8) 1, 528-36(1956) June.

A differential method has been used to measure the changes in density which accompany the annealing of plastically deformed nickel. The results of these measurements are correlated with earlier measurements of stored energy, electrical resistivity and hardness for the same material. There are two sudden increments in density; the first is attributed to the disappearance of vacancies and the second to recrystallization. These are superimposed on a gradual

increase in density attributed to recovery. There is a considerable discrepancy between the densities of dislocations calculated from the stored energy measurements and from the density measurements. (auth)

11203

SOME PROPERTIES OF VACANCIES AND INTERSTITIALS IN Cu_3Au. R. A. Dugdale (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (8) 1, 537-59 (1956) June.

A series of experiments, based on electrical resistivity measurements, have resulted in the following conclusions: The activation energy for formation of vacancies is about 1.0 ev and for migration about 0.9 ev. The ordering process, involving the interaction of vacancies with wrong atoms, is complex; at least two relaxation processes are shown to operate. The decay time of an excess vacancy concentration appears to be limited by the presence of vacancy capturing impurities, the concentration of which can be varied by suitable heat treatment. Interstitials are more mobile than vacancies at a given temperature, but these too are probably trapped and can in turn contribute to the limitation of the vacancy decay time. (auth)

11204

SCATTERING OF COLD NEUTRONS IN LIQUID METALS AND THE ENTROPY OF DISORDER. L. S. Kothari, K. S. Singwi, and S. Visvanathan (Atomic Energy Establishment, Bombay, India). Phil. Mag. (8) 1, 560-7(1956) June.

Introducing a varying degree of disorder in Mott's quasi-crystalline model of liquid metals, the change in the cold neutron scattering cross section of melting is calculated. Mott's calculations of the change in electric conductivity on melting have been repeated on the basis of this modified model using more recent data on the latent heat of fusion. It is shown that the change in the neutron scattering cross section in lead and the change in conductivity in sodium and potassium on melting can be explained if we assume that the entropy of disorder on melting is nearly 0.5R, R being the gas constant. That this value is of the right order of magnitude seems to be corroborated by self-diffusion data. (auth)

11205

RELEASE OF STORED ENERGY AND CHANGES IN LINE SHAPE DURING ANNEALING OF DEFORMED NICKEL. D. Michell (Univ. of Melbourne, Australia). Phil. Mag. (8) 1, 584-7(1956) June.

Results of stored energy measurements on deformed Ni powder are given in graphical form. Changes in line shapes were analyzed by various methods, and results from the Fourier analysis of the shape of the 111 and 222 lines from the Ni powder are also shown. The measurements indicate that recrystallization commences at approximately 400°C. (B.J.H.)

11206

AMERICAN SOCIETY FOR TESTING MATERIALS PROCEEDINGS. VOLUME 55--1955. Philadelphia, American Society for Testing Materials, 1956. 1250p.

The proceedings of the American Society for Testing Materials include all reports and papers accepted by the Administrative Committee on Papers and Publications for the Proceedings, together with discussion. The table of contents and subject and author indexes cover the papers and reports published during the current year. A list is given of the Special Technical Publications published by the society in 1955. Symposiums on Atmospheric Corrosion of Non-Ferrous Metals. Impact Testing; High Purity Water Corrosion; Insulating Oils; Speed of Testing; and the Effects of Environment on Strength, Scaling, and Embrittlement of Metals at Elevated Temperatures are included. (F. S.)

11207

THERMOCHEMICAL DATA OF ALLOYS. O. Kubaschewski and J. A. Catterall. London-New York, Pergamon Press, 1956. 200p.

Thermochemical data are given for intermetallic systems and carbides, phosphides, nitrides, sulfides, and oxides. Includes 537 references. (F.S.)

11208

ON INTERMETALLIC DIFFUSION IN GOLD-LEAD SYSTEM. A. Ascoli, E. Germagnoli, and L. Mongini (Laboratori CISE, Milan). Nuovo cimento (10) 4, 123-33(1956) July.

Diffusion of gold in lead has been investigated by means of a radioactive tracer method in the range of temperatures between 190 and 300°C. In this temperature interval, experimental values of the diffusion coefficient D fit the equation $D = 2.8 \times 10^{-3} \exp [(8.91 \cdot 10^3)/RT]$ $cm^2\ s^{-1}$, whence an activation energy $Q = (8.91 \pm 0.18) \cdot 10^3$ cal $mole^{-1}$ is obtained. (auth)

11209

A STUDY OF THE IODIDE PROCESS OF REFINING ZIRCONIUM. FACTORS THAT AFFECT THE RAPIDITY OF THE REFINING PROCESS. V. S. Emel 'uanov, N. D. Bystrov, and A. I. Evstyukhin. Soviet J. Atomic Energy, No. 1, 43-50(1956).

A glass or quartz reaction vessel, containing several molybdenum electrodes, tungsten filaments, and an ampoul of I_2, was used to study the course of the iodide process visually. Data are included on the dependence of the rate of the process on the filament temperature, the quantity of I present, the tetraiodide vapor pressure in the reaction tube, and the temperature in the reaction tube. The data show that the tetraiodide pressure in the reaction vessel strongly affects the course of the process. (B. J. H.)

11210

A RADIOCHEMICAL TECHNIQUE FOR DETERMINING THE SPECIFIC SURFACE AREA OF ALUMINIUM METAL SURFACES. John E. Lewis and Robert C. Plumb (Alcoa Research Labs., New Kensington, Penna.). Intern. J. Appl. Radiation and Isotopes 1, 33-45(1956) July.

It has been found that a phosphoric-chromic acid mixture, which dissolves the oxide on aluminium surfaces, deposits a thin film on the aluminium by reaction with it but not by reaction with the oxide. Several factors affecting the thickness and uniformity of the film have been explored. When certain of these conditions are not encountered, it is thought that the amount of the film deposited in a unit of geometric area is proportional to the actual surface area of the specimen. Attempts have been made to prepare a flattest possible aluminium surface. The roughness factor or specific surface area of an aluminium surface may be determined, using radiochemical techniques, by comparing the amount of the film formed per unit of geometric area on a given sample with the amount of film formed per unit of area on a flat sample. (auth)

11211

THE COHESIVE ENERGIES OF TRANSITION METALS. J. Stanley Griffith (Univ. of Cambridge, England). J. Inorg. and Nuclear Chem. 3, 15-23(1956) Aug.

An approximate theory of the cohesive energies of first transition-series metals is presented. It is suggested that crystal field splitting is of no appreciable importance in determining these energies. Then the cohesive energy is regarded as made up of just two parts, one arising from the breakdown of intra-atomic spin couplings and the other from the formation of interatomic ones. The former is calculated in terms of atomic spectral parameters and the latter is assumed to vary smoothly along the series with a maximum in the middle. It is shown that the theory may be extended to interpret the form of variation of cohesive energies of the remaining elements of the first long period and of the second and third also. Ferromagnetic iron is discussed from the present point of view. (auth)

11212

ZONE MELTING OF URANIUM. J. E. Antill (Atomic Energy Research Establishment, Harwell, Berks,

England). Nuclear Power 1, 155-61(1956) Aug.

Zone melting experiments in a vertical furnace have shown that to remove soluble metallic elements from uranium slow zone speeds (¼ in./hr) are necessary and density differences may be harnessed to increase the purification. The non-metallic elements carbon and oxygen may be removed at much faster zone speeds (3 ins/hr). Zone melting has been considered as a modified self-slagging process for the removal of fission products from irradiated uranium. Greater decontaminations for zirconium and for total activity were obtained than in self-slagging experiments. A certain minimum concentration of carbon and oxygen is necessary to obtain the maximum elimination of fission products. (auth)

11213

THERMAL AND ELECTRICAL CONDUCTIVITIES OF IRON, NICKEL, TITANIUM, AND ZIRCONIUM AT LOW TEMPERATURES. W. R. G. Kemp, P. G. Klemens, and G. K. White (C.S.I.R.O., Sydney, Australia). Australian J. Phys. 9, 180-8(1956) June.

Measurements are reported of the thermal and electrical conductivities of iron, nickel, titanium, and zirconium down to 2°K. These indicate that thermal conduction in pure iron and nickel is almost completely electronic. Titanium and zirconium exhibit an appreciable lattice component of thermal conduction. In the case of titanium this lattice component varies as $T^{1.5}$. The ideal electronic thermal resistivity below about 50°K was found to be $10 \times 10^{-5}\ T^{2.2}$ and $11 \times 10^{-5}\ T^2$ cm deg W^{-1} for iron and nickel respectively. The ideal electrical resistivity was found to vary as T^3 at low temperatures for all four metals. (auth)

11214

HYDROGEN EVOLUTION FROM DISSOLVING TITANIUM–OXYGEN ALLOYS IN HYDROFLUORIC ACID AND THE CONSTITUTION OF Ti–O ALLOYS. M. E. Straumanis, C. H. Cheng, and A. W. Schlechten (Univ. of Missouri School of Mines and Metallurgy, Rolla). J. Electrochem. Soc. 103, 439-41(1956) Aug.

Titanium–oxygen alloys dissolve in HF according to the reaction $TiO_x + 3HF \Longrightarrow TiF_3 + xH_2O + 0.5\ (3 - 2x)H_2$, with a maximum for x = 1.5, which means that Ti_2O_3 dissolves without H_2 evolution. Higher titanium oxides do not dissolve in HF. The determination of the end point of the above reaction was affected by a secondary, but very slow reaction $TiF_3 + HF \Longrightarrow TiF_4 + 0.5H_2$. Nevertheless, the experimental results agreed within ±2% for the first reaction for Ti containing O_2 up to 33 at. %. Titanium–oxygen alloys do not represent Ti-O solid solutions but solid solutions of titanium oxides and Ti. (auth)

11215

THE EQUILIBRIUM OF α-SILVER–CADMIUM ALLOYS WITH CADMIUM VAPOR. George Scatchard and Richard H. Boyd (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 78, 3889-93(1956) Aug. 20.

An electronic spectrophotometer is described for measuring the concentration of metal vapor in equilibrium with a solid or liquid alloy. Measurements are reported of the vapor pressures of eight α-Ag–Cd alloys from 5 to 37 at. % Cd and from about 0.02 to 0.3 mm. pressure. For each alloy the enthalpy and entropy of evaporation appear to be independent of the temperature. The enthalpy and excess entropy of mixing may each be expressed by a two parameter equation in the mole fraction. A comparison is made of the three α-alloys: Cu–Zn, Ag–Zn and Ag–Cd. (auth)

11216

THE PLUTONIUM–HYDROGEN SYSTEM. II. SOLID SOLUTION OF HYDROGEN IN PLUTONIUM DIHYDRIDE. Robert N. R. Mulford and Gladys E. Sturdy (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 78, 3897-3901(1956) Aug. 20.

Pressure–temperature–composition data are presented for the composition range PuH_2 to PuH_3. In the range PuH_2 to about $PuH_{2.75}$ hydrogen is in solid solution in the fluorite structure of PuH_2. Between compositions $PuH_{2.75}$ and PuH_3, a hexagonal hydride phase appears, and hydrogen pressures dependent on the immediate history of the sample are observed. The explanation is proposed that lack of equilibrium between hexagonal and cubic phases is responsible for the variable pressures. A tentative phase diagram for the Pu–H system is presented. (auth)

11217

THE HISTORY OF MAGNESIUM. C. J. P. Ball (Magnesium Elektron, Ltd., London). J. Inst. Metals 84, 399-411(1956) July.

A brief historical survey is given of the progress of Mg from its discovery, the production processes used in the various producing countries, and an explanation of the types of alloys developed, including the latest Mg–Zr–Zn with or without additions of rare-earth metals or thorium. A brief commentary on past and present applications and possible future developments is also given. (auth)

11218

THE PHASE SECTIONS AT 500° AND 350° C OF ALUMINIUM-RICH ALUMINIUM–COPPER–LITHIUM ALLOYS. H. K. Hardy and J. M. Silcock (Fulmer Research Inst., Ltd., Stoke Poges, Bucks, England). J. Inst. Metals 84, 423-8(1956) July.

A study has been made of the constitution at 500°C of Al–Cu–Li alloys containing up to 60 wt. % Cu and up to 20 wt. % Li. Three ternary intermetallic compounds come into equilibrium with the Al-rich solid solution: T_B with a composition of $Al_{7.5}Cu_4Li$(Al, 54.9 wt. % Cu, 1.5 wt. % Li), cubic CaF_2 structure, $a = 5.83$ A, T_1 with a composition on the Cu-rich side of Al_2CuLi(Al, 52.8 wt. % Cu, 5.4 wt. % Li), hexagonal, $a = 4.97$, $C = 9.35$ A, T_2 with a composition on the Al-poor side of Al_6CuLi_3(Al, 26.9 wt. % Cu, 8.8 wt. % Li), structure undetermined. Three further intermetallic compounds, denoted P, Q, and R, have been observed in the alloys less rich in Al than T_B, T_1, and T_2. The limits of the Al solid solution of 500°C approximate to 4.0 wt. % Cu; 4.0 wt. % Cu, 1.3 wt. % Li; 2.75 wt. % Li. The apices of the $(Al + \theta + T_B)$, $(Al + T_B + T_1)$, and $(Al + T_1 + T_2)$ phase fields lie at 4.0 wt. % Cu, 1.0 wt. % Li; 4.0 wt. % Cu, 1.3 wt. % Li; and 1.3 wt. % Cu, 2.25 wt. % Li, respectively. The $(Al + T_B)$ phase field is very narrow, and several of the alloys close to T_B do not reach equilibrium in 16 weeks at 500°C. The same compounds are present in Al-rich alloys annealed for 1 week at 350°C. At this temperature, the $(Al + T_B)$ phase field is widened at the expense of the $(Al + \theta)$ field. (auth)

11219

TRACE-ELEMENT EFFECTS IN SOME PRECIPITATION-HARDENING ALUMINUM ALLOYS. K. H. Hardy (U. K. Atomic Energy Authority (Industrial Group), Springfields, Lancs, England). J. Inst. Metals. 84, 429-39(1956) July.

High tensile values were claimed for Al–4% Cu–1% Li alloys containing Zn, Ag, Cd, In, Sn, or Hg. The significant trace elements have been sought in a recent program of work by determining those which enhance the response to artificial ageing, but which reduce the additional response associated with cold work before ageing. The results suggested that such "trace-element effects" were introduced into Al–Li and Al–4% Cu–1% Li alloys by additions of 0.05 to 0.1% Cd, In, or, to a lesser extent, Sn. The age-hardening of the Al–4% Cu–1% Li alloy was also influenced by 0.1% Ga or 1% Ag, but not by 0.45% Zn; Hg was not studied. The cost of Li, the severe oxidation of the melt, and the

difficulty of breaking down from the cast state militate against the industrial use of these alloys. The response to ageing of a range of Al–Cu, Al–Cu–Li, and Al–Li alloys in the absence and presence of 0.1% Cd has now been used to determine whether trace-element effects in precipitation reactions are specific to certain precipitates. Comparison of the age-hardening capacity with the phase diagram strongly indicates that cadmium facilitates nucleation in the systems Al–θ ($CuAl_2$), Al–T_1 (approx. Al_2CuLi), and Al–AlLi. Nucleation is unaffected in the pseudobinary systems Al–T_B (approx. $Al_{7.5}Cu_4Li$, and Al–T_2 (approx. Al_6CuLi_3). It is concluded that the easier nucleation brought about by Cd is specific to the structural relationships between the precipitate and the matrix and is unlikely to arise from changes induced in the solid solution, e.g. enhanced short-range order between the solute atoms. (auth)

11220

THE DISSOCIATION PRESSURES IN THE ZIRCONIUM–OXYGEN SYSTEM AT 1000°C. O. Kubaschewski and W. A. Dench (National Physical Lab., Teddington, England). J. Inst. Metals 84, 440-4(1956) July.

Zirconium–oxygen alloys of various compositions were equilibrated with Ca, Mg, or Ba in bombs of Zr or steel at 1000°C. After leaching, the compositions of the products were determined by means of chemical and vacuum-fusion analyses. The following equilibrium concentrations of oxygen (wt-%) in Zr–O have been found: Ca < 0.05; Mg 1.55; Ba 2.0. The free energies of dissociation of the respective oxides are known, and thus three points on the curve of the free energy of dissociation in the Zr–O system were obtained. The complete curve has been constructed using in addition the known phase boundaries of the system, and the integral free energy of formation of zirconia. The resulting curve is compared with the corresponding curves for the systems Ti–O, V–O and Fe–O. Some results obtained in the reduction of zirconia by the alkaline earth metals are presented and discussed. (auth)

11221

THE ROUTINE DETERMINATION OF THE HYDROGEN CONTENT OF ALUMINIUM AND ALUMINIUM ALLOYS BY THE HOT-EXTRACTION METHOD. C. E. Ransley and D. E. J. Talbot (British Aluminium Co., Ltd., Gerrards Cross, Bucks, England). J. Inst. Metals 84, 445-52(1956) July.

The general problem of the measurement of the H_2-content of Al and Al alloys is reviewed, and the advantages of the hot-extraction method are emphasized. The absolute accuracy and main sources of error in this method have been investigated. The total volume of gas to be measured is small, and special precautions are necessary to avoid the evolution and collection of spurious hydrogen from various sources; alloys containing Mg volatile elements need particular care in this respect. A procedure has been evolved which has given satisfactory results in routine use over a long period. The final form of apparatus adopted and the method of operation are described in detail. A simple but effective form of vacuum drill has also been developed, which can be used in conjunction with the gas-analysis apparatus. It has been found very useful for investigating the composition of gases in pores in cast alloys and in blisters in wrought products. (auth)

11222

BASIC CHARACTERISTICS OF SOME HEAT-RESISTING BRAZING FILLER MATERIALS. W. H. Chang (General Electric Co., Schenectady, N. Y.). Welding J. (N. Y.) 35, 431s-43s(1956) Sept.

The basic characteristics of two nickel–chromium–boron, one nickel–chromium–silicon, and one gold–nickel brazing filler materials have been investigated. These characteristics include surface preparation, brazing time, temperature, and atmosphere, base-material intergranular penetration, and, in particular, the effect of joint clearance on the room-temperature tensile properties of butt joints brazed with these filler materials. It is shown conclusively that the nickel–chromium–base filler materials yield satisfactory joints only at small clearances, whereas the excellent tensile properties possessed by the joints brazed with the gold–18% nickel alloy are practically not adversely affected by clearances. The dependence of intergranular penetration on both base and filler materials has also been demonstrated. All these observations have been related satisfactorily to the joint microstructures which, in turn, are explained in terms of metallurgical factors such as constitution of, and interdiffusion between, base and filler materials. Based on the experimental results, the advantages and limitations of the filler materials are evaluated. (auth)

11223

PREHEATING AND POSTHEATING FOR FIELD ERECTION OF MILD-STEEL PRESSURE VESSELS. Leon J. McGeady (Lafayette Coll., Easton, Penna.). Welding J. (N. Y.) 35, 444s-6s(1956) Sept.

Because preheating has been used primarily to prevent weld-metal cracks during fabrication, there is little evidence as to the effect preheat might have in improving weld toughness of vessels to be put into service, if used for that purpose alone. The unalloyed low-carbon steels of moderate plate thickness rarely require preheat for successful fabrication. It is the feeling of some fabricators that vessels of these steels perform successfully in service if they are fabricated successfully. However, cases are known in which weld cracking, transverse to the welds, occurred in vessels on standing under no external load, several weeks after their apparently successful fabrication. Although such happenings appear to be rare, insurance against them is quite profitable, whether obtained by thermal stress relieving or preheating. It is known that both preheat and stress relief improve service behavior of weldments to some degree. Both offer improved weld-zone toughness as an outstanding benefit. High heat-input single-pass welds with high-interpass temperatures offer the same means of retaining favorable weld-zone properties. (auth)

11224

NOTCH TOUGHNESS OF WELD DEPOSITS IN COMMERCIAL TITANIUM ALLOYS. D. M. Daley, Jr. and C. E. Hartbower (Watertown Arsenal, Mass.). Welding J. (N. Y.) 35, 447s-56s(1956) Sept.

The objective of this investigation is to determine the notch toughness of the deposited weld metal and the notch toughness of the heat-affected base metal in commercially available titanium. Weldments were prepared using the inert-gas-shielded consumable-electrode process. Materials used consisted of unalloyed titanium, Ti–7%, Mn and Ti–4%, Cr–2% Fe. Data from various weld and base metal combinations indicate that low-alloy weld deposits formed either by depositing alloy titanium in unalloyed base metal or by depositing unalloyed titanium in alloy base metal develop good toughness. The notch toughness of weld heat-affected zone relative to the deposited weld metal as determined by the WAL composite V-notch Charpy impact specimen was poor in the commercially available alpha-beta alloys investigated. (auth)

11225

CARBON MIGRATION IN WELDED JOINTS AT ELEVATED TEMPERATURES. R. J. Christoffel and R. M. Curran (General Electric Co., Schenectady, N. Y.). Welding J. (N. Y.) 35, 457s-68s(1956) Sept.

Carbon migration in composite weldments can result in a

depletion of carbon on one side of the fusion line and a concentration on the other side. The extent of carbon migration depends on the particular alloy combinations involved and is not strictly a function of the absolute difference in alloy content. A parameter relationship establishing the equivalence between time and temperature for carbon migration in composite weldments was developed. Physical tests were conducted on sample aged to simulate the extent of carbon migration expected in long time service at elevated temperatures. While these tests did not show that carbon migration had a profound effect on physical properties, the operation of composite weldments at temperatures at which carbon migration may occur should be carefully evaluated. (auth)

11226

CORROSION OF NICKEL–CHROMIUM–IRON ALLOYS BY WELDING SLAGS. G. R. Pease (International Nickel Co., Inc., Bayonne, N. J.). Welding J. (N. Y.) 35, 469s-72s (1956) Sept.

Evidence has accumulated that incompletely removed welding slag residues can initiate rapid corrosive attack on alloys used in high temperature service. The nature of the attack is described, under both oxidizing and reducing conditions, and the temperature limits defined within which damage can be expected. Experimental proof is offered that welding slag residues can act as collectors or scavengers of sulfur and thereby cause damage by sulfidation in atmospheres which are otherwise harmlessly low in sulfur content. (auth)

11227

INTERNAL FRICTION AND GRAIN BOUNDARY VISCOSITY OF COPPER AND OF BINARY COPPER SOLID SOLUTIONS. L. Rotherham and S. Pearson (U. K. Atomic Energy Authority, Warrington, England). J. Metals 8, 881-92(1956) Aug.

Measurements have been made of the variation of internal friction with temperature for OFHC copper, and for a series of binary solid solutions of high purity copper with zinc, gallium, germanium, arsenic, and silicon, to investigate the effect of alloying elements in substitutional solid solution on grain boundary viscosity. The apparatus used was of the torsional pendulum type developed by Ke, modified so that the specimen and vibrating system could be maintained in a high vacuum. The activation energy for grain boundary relaxation in copper is 33,000 cal per mol. This is considerably less than the activation energy for self-diffusion, in disagreement with Ke's theory that the two activation energies should be the same. All the alloying elements increase the activation energy for grain boundary relaxation to approximately 44,000 cal per mol, increasing the grain boundary viscosity at a given temperature. The results are discussed in terms of theories of grain boundary slip put forward by Mott and by Ke. Experiments have also been made to investigate the effect of small amounts of oxygen on the variation of internal friction with temperature for copper. (auth)

11228

ORIENTATION RELATIONSHIPS BETWEEN ALPHA PRIME AND BETA PHASES IN A Ti–Ni ALLOY. D. H. Polonis and J. Gordon Parr (Univ. of British Columbia). J. Metals 8, 892-3(1956) Aug.

The orientation relationships in a Ti alloy containing 8 at. % Ni were determined by a method of "spotty" x-ray-diffraction films. The principle of the technique is described. (J.E.D.)

11229

INTERNAL FRICTION AND GRAIN BOUNDARY VISCOSITY OF SILVER AND BINARY SILVER SOLID SOLUTIONS. S. Pearson and L. Rotherham (U. K. Atomic Energy Authority, Warrington, England). J. Metals 8, 894-901(1956) Aug.

Measurements have been made of the variation of internal friction with temperature for spectroscopically pure silver, and for a series of solid solutions of silver with cadmium, indium, and tin, using a Ke-type torsion pendulum apparatus. Some experiments have also been made to investigate the effect of nonmetallic impurity on grain boundary relaxation in silver. The effect of the alloying elements is to increase the grain boundary viscosity, and to raise the activation energy for grain boundary relaxation from 22,000 cal per mol for pure silver to 43,000 cal per mol for the solid solutions; the same value being obtained, within the limits of experimental error, for all the alloying elements and solute concentrations investigated. Results of the experiments show exactly the same trend as those obtained previously for a similar series of copper solid solutions. They are in agreement with the general theory of grain boundary relaxation developed by Zener and Ke, but do not seem to be in agreement with either of the mechanisms so far put forward to explain grain boundary slip. (auth)

11230

EFFECT OF TESTING VARIABLES ON THE HYDROGEN EMBRITTLEMENT OF TITANIUM AND A Ti-8 PCT Mn ALLOY. R. I. Jaffee, G. A. Lenning, and C. M. Craighead (Battelle Memorial Inst., Columbus, Ohio). J. Metals 8, 907-13(1956) Aug.

The effects of increasing H content, introducing a notch, and changing the strain rate on properties of Ti and one of its alloys were investigated over a range of testing temperatures from –196 to 200°C. Both high purity and commercial purity A-55 Ti were used as representative α materials, while a commercial Ti-8% Mn alloy was used for an α-β alloy. It was found possible to analyze the data, using the ductile-to-brittle transition temperature concept. Increasing hydrogen, the presence of a notch, and increasing the testing speed raised the transition temperature for the α materials. The presence of H and notches raised the transition temperature of the α-β alloy also. However, increasing the testing speed generally decreased the transition temperature of the α-β alloy. (auth)

11231

FURTHER STUDIES OF THE PROPERTIES OF RHENIUM METAL. Chester T. Sims and Robert I. Jaffee (Battelle Memorial Inst., Columbus, Ohio). J. Metals 8, 913-17 (1956) Aug.

The thermoelectric behavior of the Pt–Pt-Re thermocouple and the resistance of rhenium to attack by certain molten metals is discussed. In addition, data are presented on the stress-rupture behavior of drawn wire, the tensile characteristics of rolled sheet, the variation of Young's modulus with temperature, and the effect of specimen size and fabrication method on the work hardenability. Mechanical properties of thoriated rhenium are discussed. This includes data on the effect of thoria in rhenium on tensile properties, ductility, work hardening, and recrystallization. (auth)

11232

HYDROGEN EMBRITTLEMENT OF BETA-STABILIZED TITANIUM ALLOYS. C. M. Craighead, G. A. Lenning, and R. I. Jaffee (Battelle Memorial Inst., Columbus, Ohio). J. Metals 8, 923-8(1956) Aug.

The α-β type alloys are subject to a loss of tensile ductility with increasing hydrogen content. No hydride phase is visible in embrittled α-β type alloys. The embrittlement encountered appeared to be of the strain-aging type. Both compositional and structural factors are shown to influence the hydrogen tolerance of α-β type alloys. (auth)

11233
INVESTIGATION OF THE PARTIAL CONSTITUTION DIAGRAM Ti–$TiAu_2$. Paul Pietrokowsky, Ellis P. Frink, and Pol Duwez (California Inst. of Tech., Pasadena). J. Metals 8, 930-5(1956) Aug.

Ti–Au alloys in the composition interval 0 to 66⅔ at. % Au have been studied over a temperature range from 400 to 1500°C. A partial phase diagram has been established from micrographic and macroscopic observations. All intermediate phases, Ti_3Au, TiAu, and $TiAu_2$, exhibit open melting maxima. It has been observed that small additions of gold lower the allotropic transformation temperature of titanium. The β solid solution decomposes eutectoidally to α solid solution plus Ti_3Au. The solubility of gold in α solid solution decreases with temperature. (auth)

11234
BETA PHASE PARAMETERS IN THE SYSTEM Ti–V–Mo. Jack L. Taylor (California Inst. of Tech., Pasadena). J. Metals 8, 959-61(1956) Aug.

As expected from similar crystal structures and favorable atomic size factors, titanium, vanadium, and molybdenum are completely soluble in one another above the transformation temperature of titanium. The β phase parameters of the continuous solid solution are shown graphically. Limiting compositions for retained β phase have been determined. (auth)

11235
MICROSTRUCTURAL DIFFERENCES IN TEMPERED TITANIUM ALLOYS. L. D. Jaffe (California Inst. of Tech., Pasadena). J. Metals 8, 961-2(1956) Aug.

11236
EFFECT OF THE ANNEALING TEMPERATURE ON THE FORMATION OF THE CUBE TEXTURE. Alfonso Merlini (Univ. of Illinois, Urbana). J. Metals 8, 967-72(1956) Aug.

By a suitable choice of the penultimate grain size and the rolling reduction, an OFHC copper strip was produced which has a low temperature, 315°C, annealing texture containing, in addition to the cube texture component, four components similar to those of the deformation texture. After annealing at high temperature, 825°C, the amount of cube texture is much larger than that obtained at low temperature. It is not appreciably influenced by a previous anneal of the specimen at low temperature. This result contradicts the oriented nucleation theory, but is in excellent agreement with the principles of the oriented growth theory. (auth)

11237
INTERNAL FRICTION STUDIES ON SILVER AND CERTAIN SILVER-BASE SOLID SOLUTIONS. S. G. Holder, Jr., E. E. Stansbury, and J. H. Frye, Jr. (Univ. of Tennessee, Knoxville). J. Metals 8, 993-7(1956) Aug.

Internal friction studies on annealed and cold-worked pure silver and alloys of silver with 4.5 atomic pct each of Cd, Sn, and Sb are reported. Small amounts of cold work, introduced by stretching pure silver, decrease the internal friction; large amounts of cold work, by wire drawing, cause this decreased internal friction to rise. Results of several annealing histories on the room-temperature internal friction indicate a rather complex recovery and recrystallization behavior. A rather systematic alloy effect is observed for the elements of Period V-B in silver in both the annealed and cold-worked states. (auth)

11238
MARTENSITIC TRANSFORMATION IN BINARY TITANIUM ALLOYS. Y. C. Liu (New York Univ.). J. Metals 8, 1036-40(1956) Aug.

Both the habit plane of martensite and the orientation relationship between the matrix and martensite platelets of different habit planes have been investigated in binary Ti alloys with Mo, Cr, and Fe. The effect of the mode of deformation on the martensite habit plane was studied. A micrograph of an exposed martensite platelet is presented. (auth)

11239
MELTING AND FABRICATING BINARY URANIUM ALLOYS. F. R. Lorenz, W. B. Haynes, and E. S. Foster (Westinghouse Electric Corp., Pittsburgh). J. Metals 8, 1076-80(1956) Aug.

Vacuum induction melting and consumable electrode arc melting have been used in the preparation of alloys of molybdenum, columbium, and silicon with uranium. These two methods have been combined into a duplex melting technique enabling the production of sound, homogeneous ingots up to 4-in. diam, weighing approximately 50 lb. In vacuum induction melting, certain special melting refractories are used to reduce the impurity contamination in the alloy casting in order to achieve the desired corrosion resistance of the fuel material. In consumable arc remelting of induction castings, no detectable quantities of additional impurities are introduced or removed. Binary alloys of uranium with molybdenum and columbium made by this duplex method have been fabricated by extrusion, forging, rolling, and swaging. No defects have been noticed in the finished product. The silicon alloy has been worked successfully only by extrusion. (auth)

11240
VAPOR PRESSURE OF LIQUID COPPER AND ACTIVITIES IN LIQUID Fe–Cu ALLOYS. J. P. Morris and Glenn R. Zellars (U. S. Bureau of Mines, Pittsburgh). J. Metals 8, 1086-90(1956) Aug.

The carrier gas method was used to measure the vapor pressure of copper over liquid copper and Fe–Cu alloys. From these results, the activity of copper in the alloys was determined at 1466, 1550, and 1600°C. Calculations of the activity of iron were made from the results for copper. The activities of copper and iron show strong positive deviations from Raoult's law. (auth)

11241
EFFECT OF PROLONGED HEATING AT HIGH TEMPERATURE ON THE HARDENABILITY OF BORON-TREATED STEELS. R. M. Goldhoff, R. Speiser, and J. W. Spretnak (Ohio State Univ., Columbus). J. Metals 8, 1091(1956) Aug.

11242
ACTIVITY COEFFICIENT OF COPPER IN LIQUID IRON, Fe–C, and Fe–C–Si ALLOYS AT 1600°C. Peter J. Koros and John Chipman (Massachusetts Inst. of Tech., Cambridge). J. Metals 8, 1102-4(1956) Aug.

The distribution of Cu between liquid Ag and liquid Fe, Fe–C, and Fe–C–Si alloys was studied at 1600°C. From the data and the activity of Cu in Ag obtained from the phase diagrams, the activity coefficients of Cu in Fe up to 3 at. % are $\log \gamma_{Cu} = 0.90 - 2.4\ N_{Cu}$ and $\gamma^0_{Cu} = 8.0$. The effect of carbon up to saturation is expressed as $\log \gamma^{(C)}_{Cu} = 1.8\ N_C$. The effect of Si up to 11 at. % is insignificant. (auth)

PHYSICS

11243 AERE-C/R-392
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE PREPARATION OF FILMS AND COATINGS. F. Hudswell. Oct. 1949. 19p.

Some methods for the deposition of films and coatings of elements and compounds are described and discussed. The applicability of the methods to the treatment of radioactive materials is indicated. (auth)

11244 AERE-I/M-21

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

DETECTION OF LEAKING JOINTS IN WATER PIPES UNDER CONSTRUCTION. S. Jefferson, J. F. Cameron, and J. L. Putmen. Feb. 3, 1953. 5p.

Preliminary tests of two methods for finding leaking joints in water mains are described. Both methods use Na^{24} as a tracer. The main is filled with an active solution and pumped up to test pressure for half an hour. In the first method samples of mud and water from the neighborhood of the main are brought to the surface and examined for activity. In the second method, the active contents of the pipe are moved along to another section of pipe and a Geiger probe is used to check the earth surrounding the pipe for activity. (auth)

11245 SC-3610(TR)

Sandia Corp., Albuquerque, N. Mex.

PRELIMINARY INVESTIGATION OF DUST RAISED BY BLAST WAVES. (OPERATION GREASY STAKE). J. R. Banister and R. J. Emrich. Jan. 3, 1955. Changed from OFFICIAL USE ONLY June 22, 1956. 40p. Contract AT(29-1)-789. $6.30(ph OTS); $3.00(mf OTS).

Blast waves from HE detonations have been found capable of raising considerable amounts of dust. The dust cloud appears immediately after the shock front passes and rises throughout the positive phase at a rate proportional to the initial overpressure at the station. The concentration of suspended dust is significant at higher overpressures. These experimental results may be compared with the early stages of the dust cloud raised by nuclear blast waves having Mach configuration. (auth)

11246 AEC-tr-2606

THE TRANSFER OF MASS AND CHARGE BY SURFACE WAVES. A. A. Vlasov. Translated from Zhur. Eksptl'. i Teoret. Fiz. 27, 224-42(1954). 17p.

The boundary problem of the many-body theory leads to the conclusion that the transfer of material by means of surface waves is present. The mechanism developed is concretized for capillary waves in He II and for electrical surface waves in the electronic plasma of superconductors. (auth)

11247 AEC-tr-2638

INFLUENCE OF ELASTIC STRESSES ON RECRYSTALLIZATION TEXTURES. Hans Stadelmaier and B. F. Brown. Translated from Z. Matallkunde 47, 1-8(1956). 29p.

Genuine nucleation in the classical sense proceeds preferably during plastic deformation. The anisotropy of the volume energy of a nucleus being stressed elastically during deformation causes a minimum value of the nucleation energy for the cube texture and the [100]-fiber texture. The appearance of the cube texture depending on the degree of deformation, alloying additions and initial grain size is closely connected with the strain hardening behavior during deformation. Copper, while recrystallizing in the cube texture, after rolling shows in wires a "cyclic cube texture" hitherto unobserved and unpredicted by any recrystallization theory. (auth)

11248

VACUUM SEAL FOR THIN METAL WINDOWS. Melvin H. Mueller (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 27, 411(1956) June.

A method is presented for vacuum sealing of thin metal windows such as the Be windows in high-temperature x-ray cameras. A modification of the O-ring type seal was developed for curved windows. (W.L.H.)

11249

DEVELOPMENT OF THE ROSSI CURVE FOR GREAT THICKNESS OF Pb. L. Janossy and L. Nagy. Z. Naturforsch. 11a, 312-15(1956) Apr. (In German)

11250

THE FORM OF SHOWER RELEASE CURVE WITH GREAT LEAD THICKNESS. H. Faissner, K. H. Lauterjung, and B. Schimmer. Z. Naturforsch. 11a, 315-22(1956) Apr. (In German)

11251

APPLIED X-RAYS. Fourth Edition. George L. Clark. New York-Toronto-London, McGraw-Hill Book Co., Inc., 1955. 843p.

In the fourth edition of this book the same general plan of organization is retained as in the third edition. A new chapter on microradiography is introduced and chapters on biological effects, interpretation of diffraction patterns, textures of metals, and polymers have been expanded to include essential information. (F. S.)

11252

AN ENGINEERING APPROACH TO BLAST RESISTANT DESIGN. Nathan M. Newmark (Univ. of Illinois, Urbana). Trans. Am. Soc. Civil Engrs. 121, 45-84(1956).

The problem of blast-resistant design is approached directly by means of reasonable simplifying assumptions. The resulting design procedure avoids time-consuming and misleading analysis. The procedure and the necessary mathematical relationships are presented and their practical application is explained. (auth)

AEROSOLS

11253 UR-461

Rochester, N. Y. Univ. Atomic Energy Project.

STUDIES ON THE RADIOACTIVE AEROSOL PRODUCED BY RADON IN AIR. Jacob Shapiro. Aug. 30, 1956. 32p. Contract W-7401-eng-49. $6.30(ph OTS); $3.00(mf OTS).

The radioactive aerosol produced by radon in air was studied by measuring the radioactivity deposited in plastic tubes through which the air was drawn. The experimental results were used to obtain diffusion coefficients for the airborne radioactivity carried on nuclei. The diffusion coefficients ranged between 10^{-6} to 10^{-5} cm^2/sec. Deposition of the radioactivity in the tracheae of rats was also measured and compared with deposition in plastic tubes of similar dimensions. (auth)

11254

ELECTROSTATIC PARTICLE SIZE ANALYZER. Herbert H. Yoshikawa, George A. Swartz, John T. MacWaters, and Wade L. Fite (Univ. of Pennsylvania, Philadelphia). Rev. Sci. Instr. 27, 359-62(1956) June.

This paper comprises the theoretical analysis and physical description of an Electrostatic Particle Size Analyzer (EPSA) for determining the particle size distribution of aerosols in the 1- to 20-micron size range. Included are photographs and histograms illustrating the size separation attained and also a histogram of the particle size distribution in the general aerosol as determined by use of the instrument. (auth)

COSMIC RADIATION

11255

A NEW ERUPTION OF SOLAR COSMIC RAYS. A. Ehmert and G. Pfotzer. Z. Naturforsch. 11a, 322-4(1956) Apr. (In German)

11256

THE OBSERVATION OF COSMIC RAY ERUPTION ON FEBRUARY 23, 1956 IN FREIBURG. A. Sittkus, W. Kühn, and E. Andrich. Z. Naturforsch. 11a, 325-6(1956) Apr. (In German)

11257
THE ASCENT OF COSMIC RADIATION ON FEBRUARY 23, 1956. Bernhard Meyer. Z. Naturforsch. 11a, 326(1956) Apr. (In German)

11258
CONCERNING THE EMISSION OF COSMIC RAYS FROM Pb. H. Faissner, K. H. Lauterjung, and B. Schimmer. Z. Naturforsch. 11a, 549-55(1956) July. (In German)

11259
DIURNAL VARIATION OF COSMIC RAY INTENSITY. E. Remy and A. Sittkus. Z. Naturforsch. 11a, 556-61(1956) July. (In German)

The total cosmic-ray intensity was measured in 1953 near Freiburg i.Br. (48° N, 8° E, 1200m) by a counter-telescope in three different ranges of zenith-angle (center of gravity 10°, 20°, 30°). The behavior of inclined radiation with the center of gravity at 40° can be deduced from these measurements by calculation. From the examination of the diurnal variation, obtained by averaging over three days only, the following factors can be seen: There are often several maxima and minima during one day. The time, the height, and the number of maxima change from day to day. A correlation with earthmagnetic disturbances with 27-day-recurrence-tendency is indicated. The diurnal variation of cosmic-rays coming near the vertical differs strongly from those coming from inclined directions. The dependence of zenith-angle is variable. (tr-auth)

11260
HIGH ENERGY INTERACTIONS IN COSMIC RADIATION. E. Lohrmann. Z. Naturforsch. 11a, 561-79(1956) July. (In German)

11261
UNUSUAL INCREASE OF COSMIC RADIATION ON FEBRUARY 23, 1956. A. Sittkus. Z. Naturforsch. 11a, 604-6 (1956) July. (In German)

11262
CASCADE CURVES FOR ELECTRONS AND PHOTONS FROM LEAD. I. P. Ivanenko (Lomonosov, Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 107, 819-22(1956) Apr. 21. (In Russian)

A "method of moments" offered by S. Z. Belenskiĭ Zhur. Eksptl.' Tekh. Fiz. 22, 102(1952) has been used in developing cascade curves for electrons and protons from lead. Equations were derived considering the relation of the photon absorption coefficient $\sigma(E)$ to the energy and Coulomb scattering of charged particles. Recurring expressions based on the function of "equilibrium" (integrated on the depth of spectra, which is the zero moment) permit the calculation of all the succeeding moments of t^{-n}. The radiation t-unit in lead was taken as equal to 5.9 g/cm^2. Results of calculations are tabulated. (R.V.J.)

11263
UNIQUE FLASH OF COSMIC RAYS OF GREAT INTENSITY. A. I. Kuz'min, G. V. Skrypin, G. V. Tyanutova, and Yu G. Shafer (Yakutsk Branch of Acad. of Science). Doklady Akad. Nauk S.S.S.R. 108, 66-8(1956) May 1. (In Russian)

On Feb. 23, 1956 at 3:45 Greenwich time, in the town of Yakutsk, three instruments of the Cosmic Radiation Lab. recorded a flash of cosmic rays of great intensity. The ionization chambers recorded a 200% increase from the mean value. Crossed counter telescopes recorded an increase of the same magnitude. The earth remained quiet and only rare pulsations of H compound were observed. Atmospheric pressure remained unchanged but there was a sudden 10° temperature increase. At 4:00 o'clock Greenwich time, the ionization station in Yakutsk recorded complete radiowave absorption in the 2- and 7-megacycle bands. During the flash all radio communications were interrupted in Yakutsk territory. This ionospheric disturbance was due to an unprecedented chromospheric explosion on the sun. Previously recorded flashes were much weaker. A 200% increase in intensity of cosmic rays along the vertical and the considerable influx of cosmic radiation from the south, as well as the analysis of other data indicated that the intensity flash was induced by particles of 10^9 to 10^{10} ev, which originated on the sun. (R.V.J.)

11264
ON THE ANELASTICITY OF COSMIC RAY JETS. A. Wataghin (Univ. of Torin). Nuovo cimento (10) 4, 154-5 (1956) July.

An analysis was made of 35 cosmic showers found in nuclear emulsions exposed at altitudes of ~ 30 km. (B.J.H.)

11265
FURTHER MEASUREMENTS ON CHARGED V-EVENTS. W. A. Cooper, H. Filthuth, J. A. Newth, and R. A. Salmeron (CERN, Geneva, Switzerland). Nuovo cimento (10) 4, 390-409(1956) Aug.

The decays of 150 charged V particles from lead and copper have been ovserved in a magnetic cloud chamber. Among the slow charged V events, which are all interpreted as K mesons, the proportions of the different decay modes are in good agreement with the results given by nuclear emulsions. This evidence agrees with that of other experiments which suggests that an appreciable fraction of the charged V events with high energy (> 1 Bev) are due to the decays of hyperons. Data on the positive to negative ratio of slow K mesons are discussed and a partial explanation in terms of the energy dependence of the production cross-section is suggested. Among the 150 events, 3 are most easily interpreted as the decays of K_β mesons and 1 as the decay of a Σ^+ particle. In addition 10 events are interpreted as the decays of τ mesons, of which 1 is negative. (auth)

11266
SELECTED COSMIC-RAY ORBITS IN THE EARTH'S MAGNETIC FIELD. F. S. Jory (Univ. of Chicago). Phys. Rev. 103, 1068-75(1956) Aug. 15.

A set of 663 charged-particle orbits in the earth's dipole magnetic field has been obtained by integration, using the AVIDAC computer of the Argonne National Laboratory. The orbits integrated were selected according to their usefulness in the analysis of cosmic-ray intensity increases associated with solar flares. The calculation of intensity increases for different locations on the earth is discussed using the orbit results. (auth)

11267
LATITUDE EFFECT OF THE COSMIC RAY NUCLEON AND MESON COMPONENTS AT SEA LEVEL FROM THE ARCTIC TO THE ANTARCTIC. D. C. Rose, K. B. Fenton, J. Katzman, and J. A. Simpson (National Research Council of Canada, Ottawa and Univ. of Chicago). Can. J. Phys. 34, 968-84(1956) Sept.

Results are presented of cosmic ray measurements taken at sea level during 1954–55 from the Arctic to the Antarctic. The equipment consisted of a neutron monitor and a meson telescope. Latitude effects of 1.77 for the nucleonic component and 1.15 for the meson component were measured. The longitude effect at the equator was much less than expected on the basis of the geomagnetic eccentric dipole and the longitude effect at intermediate northern latitudes shows that the longitude of the effective eccentric dipole is considerably west of that of the geomagnetic eccentric dipole. In a previous paper by the same authors, the positions of the equatorial minima were combined with other published cosmic ray measurements to calculate a new cosmic ray geomagnetic equator. New coordinates are derived on the assumption that these equatorial coordinates apply to a new eccentric dipole,

and, therefore, that the equatorial coordinates may be extended to high latitudes. When the complete results are plotted on these coordinates, it is found that an eccentric dipole representation of the earth's magnetic field is inconsistent with the combined observations at all latitudes. (auth)

11268
OBSERVATION OF THE LARGE COSMIC RAY INCREASE OF FEBRUARY 23, 1956 IN THE U.S.S.R. L. I. Dorman, N. S. Kaminer, V. K. Koiava, Yu. G. Shafer, and B. F. Shwartzman. Nuclear Phys. 1, 585-92(1956) July.

Plots of cosmic ray activity during the Feb. 23, 1956 shower are given for five observation points in the U.S.S.R. (D. E. B.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

11269
GAMMA AND PHOTOLUMINESCENCE YIELDS IN ORGANIC CRYSTALS. Z. A. Chizhikova and M. D. Galanin (P. N. Lebedev Physical Inst.). Soviet Phys. JETP 3, 115-16(1956) Aug. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 187-8(1956) Jan. (In Russian)

An attempt was made to determine whether ρ, the effectiveness of γ and photoexcitation, differs appreciably for various substances. Thus the relative luminescence yields during γ and photoexcitation were measured by observation of the average intensity of luminescence and by observation of individual scintillations. Measurements were made on tolane, stilbene, naphthalene, terphenyl, dibenzyl, KI–Tl, NaI–Tl, and naphthalene with anthracene. For organic crystals it was found that ρ is the same within ±15%. (B.J.H.)

11270
THE EFFECT OF ABSORPTION OF LUMINESCENCE ON ITS INTENSITY IN THE POWDERED LUMINOPHORS. A. P. Ivanov. Soviet Phys. JETP 3, 121-3(1956) Aug. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 196-7(1956) Jan. (In Russian)

Equations are developed which consider the influence of the absorption of the luminescence light on the intensity of luminescence in powdered phosphors. (B.J.H.)

11271
THE Θ′ STRUCTURE IN ALUMINIUM COPPER ALLOYS. J. M. Silcock (Fulmer Research Inst. Ltd., Stoke Poges, Bucks, England) and T. J. Heal (U. K. Atomic Authority, Warrington, England). Acta Cryst. 9, 680(1956) Aug.

The Θ′ structure is presented for Al–Cu alloys. A table of intensities of Θ′ reflections is given. (W.L.H.)

11272
DIELECTRIC ABSORPTION IN LITHIUM FLUORIDE. J. S. Dryden (Commonwealth Scientific and Industrial Research Organization, Sydney, Australia). J. Chem. Phys. 25, 222-4 (1956) Aug.

The dielectric loss in single crystals of LiF has been examined between temperatures of 0 and 130°C. At the lower temperatures the dielectric loss, as a function of frequency, passes through a definite maximum and is quite distinct from the background loss due to d-c conductivity. From the experimental results, the frequency factor (7×10^{12} sec) and energy barrier (0.65 ev) are derived. After darkening with x rays the absorption disappears and reappears again after bleaching. (auth)

11273
CORRELATION EFFECTS IN DIFFUSION IN CRYSTALS. A. D. LeClaire and A. B. Lidiard (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (8) 1, 518-27(1956) June.

It is a feature of many atomic diffusion jump mechanisms that successive jumps of an atom are 'correlated' in the sense that the direction of a jump is not completely at random but is influenced to some extent by the direction of the preceding jump or jumps. General formulae are derived for the diffusion coefficient which take account of this correlation. The theory is applied to a calculation of the diffusion coefficient of solute atoms by the Johnson mechanism. (auth)

11274
DECAY TIME OF ZnS(Ag) AND PREPARATION OF ZnS(Ag) RECEIVER. B. Chinaglia, F. Demichelis, and R. A. Ricci (Istituto di Fisica Sperimentale del Politecnico, Torin). Nuovo cimento (10) 4, 134-7(1956) July. (In Italian)

Refer also to abstract 11385.

ELECTRICAL DISCHARGE

11275 AEC-tr-2564
THE MOVEMENT OF POSITIVE IONS IN THEIR OWN GAS. Yu. M. Kagan and V. I. Perel. Translated from Doklady Akad. Nauk S.S.S.R. 98, 575-8(1954). 5p.

The drift velocity is calculated using a kinetic equation on the "estafette analog" for cases of weak and strong fields. Plots of the calculated values show agreement of calculated and experimental values for inert gases. (D.E.B.)

11276 AEC-tr-2572
DEVELOPMENT OF ELECTRIC DISCHARGES ACROSS LONG GAPS. V. S. Komelkov. Translated from Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, No. 6, 851-65 (1950). 16p.

Existing theories of long gap discharge are discussed, and the disagreements of theory and experiment are noted. A theory is advanced which is believed to adequately describe both the leader stage and the main discharge. (D.E.B.)

11277 AEC-tr-2574
EXCITATION TEMPERATURE IN THE PLASMA OF GAS DISCHARGE. A. D. Sakharov. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 12, 372-5(1948). 5p.

Optical measurement of gas discharge temperature has limited significance if thermodynamic equilibrium has not been established for the electrons, ions, and molecules of the plasma. Equations are developed which indicate the import of optically measured temperatures in such cases of non-equilibrium. (D.E.B.)

11278 AEC-tr-2591
HIGH-CURRENT STAGE OF AN ELECTRIC SPARK IN A GAS AT ATMOSPHERIC PRESSURE. [PART] I. I. S. Marshak. Translated from Zhur. Eksptl'. i Teoret. Fiz. 16, 703-16(1946). 18p.

Available experimental work on the stages of spark gap breakdown was reviewed, and the results were summarized. A theoretical framework for the late stages of breakdown was developed. (D.E.B.)

11279 AEC-tr-2592
HIGH-CURRENT STAGE OF AN ELECTRIC SPARK IN A GAS AT ATMOSPHERIC PRESSURE. PART II. I. S. Marshak. Translated from Zhur. Eksptl'. i Teoret. Fiz. 16, 718-27(1946). 13p.

The proposed theory of a saturated discharge is in good qualitative agreement with all assembled experimental material. The cause for the occurrence of saturation during a high-power breakdown is the achievement of almost complete gas ionization. The quasi-stationary, saturated discharge is characterized basically by complete ionization of the gas; equilibrium between the power delivered to the

gas in the channel; a high electrical gradient in the positive column; and equality between the temperatures of electrons and molecules (ions). (auth)

11280 AEC-tr-2594
THE THEORY OF PLASMA IN A RAREFIED GAS WHEN THE CURRENT IS VARIABLE. V. L. Granovskii (Granovsky). Translated from Zhur. Eksptl'. i Teoret. Fiz. 22, 3-10(1952). 9p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 6-6390. (D.E.B.)

11281 AEC-tr-2596
SINGLE-ELECTRODE HIGH FREQUENCY DISCHARGE AT PRESSURES RANGING FROM A FEW MILLIMETERS OF MERCURY TO ATMOSPHERIC PRESSURE AND AT A FREQUENCY OF 31.7 MEGACYCLES. G. S. Solntsev (Solnsev), M. Z. Khokhlov, and E. A. Rodina. Translated from Zhur. Eksptl'. i Teoret. Fiz. 22, 406-13(1952). 9p.

The boundaries of the transition from flame discharge to a low-pressure single-electrode discharge were determined for air, N_2, and A as a function of power and pressure. The stages of the discharge and the appearance of oscillations and striations are discussed. (D.E.B.)

11282 AEC-tr-2600
PLASMA OSCILLATIONS IN A MAGNETIC FIELD. G. V. Gordeev (Gordeyev). Translated from Zhur. Eksptl'. i Teoret. Fiz. 23, 660-8(1952). 10p.

Longitudinal oscillations of plasma in a constant magnetic field are investigated. The dispersion equation is derived, and the frequency and damping of the oscillations of the plasma in the magnetic field are evaluated. It is shown that when strong fields are present an anomalous dispersion occurs, and self-excitation of oscillations is possible. (auth)

11283 AEC-tr-2602
ANOMALOUS ELECTRON EMISSION OF TUNGSTEN HEATED BY A HIGH-DENSITY CURRENT PULSE. S. V. Lebedev and S. E. Khaikin. Translated from Zhur. Eksptl'. i Teoret. Fiz. 26, 723-35(1954). 11p.

Electron emission by W heated by high-density current pulses is greater than emission at the melting point. (D.E.B.)

11284 AEC-tr-2604
DIELECTRIC PERMEABILITY OF PLASMA LOCATED IN A STATIONARY MAGNETIC FIELD. M. E. Gertsenshtein. Translated from Zhur. Eksptl'. i Teoret. Fiz. 27, 180-8 (1954). 11p.

The dielectric permeability is calculated for plane waves in a homogeneous anisotropic plasma in a constant uniform magnetic field. The complex dielectric permeability is considered to be the ratio of the complex amplitudes of the resultant current density and the displacement current. (D.E.B.)

11285 AEC-tr-2609
ELECTROACOUSTICAL WAVES IN GASEOUS-DISCHARGE PLASMA. M. V. Konyukov (Koniukov) and Ia. P. Terletskii. Translated from Zhur. Eksptl'. i Teoret. Fiz. 27, 542-8 (1954). 9p.

On the basis of a system of hydrodynamic equations for electron and ion gases, and the equations of electrodynamics, the problem of the propagation of electroacoustical waves in plasma is solved. It is shown that when the friction with neutral gas and the creation of particles due to ionization are taken into account in a cylindrically-symmetrical discharge, two types of waves may travel along the axis of the discharge tube—electron waves and ion waves. The electron waves are rapidly damped; the ion waves are both damped and of the type which build up. (auth)

11286 AEC-tr-2610
ON SOME PROPERTIES OF A WEAKLY NON-IDEAL ELECTRON GAS. G. E. Zilberman. Translated from Zhur. Eksptl'. i Teoret. Fiz. 27, 549-56(1954). 11p.

A study is made of the conditions under which the interaction of electrons may be treated as a perturbation, and also of the question of the choice of the perturbation operator. For T = 0 the free energy of a weakly non-ideal electron gas is found, and its magnetic susceptibility is calculated. It is shown that the period of oscillation of the susceptibility does not depend on the chemical potential in same way as for noninteracting electrons. The explicit form of the actual dependence allows the determination of the law of dispersion of the quasiparticles for T = 0 near the limit of the Fermi distribution, and an extension of the theory to temperatures near the absolute zero. (auth)

11287 AEC-tr-2614
ON LONGITUDINAL VIBRATIONS OF PLASMA. [PART] I. A. A. Luchina. Translated from Zhur. Eksptl'. i Teoret. Fiz. 28, 18-27(1955). 14p.

The problem of propagation of longitudinal waves in a plasma under given boundary conditions is solved. A "dispersion" equation which takes into account motion of the ions is obtained. (auth)

11288 AEC-tr-2615
ON LONGITUDINAL VIBRATIONS OF PLASMA. [PART] II. G. Ya. Myakishev and A. A. Luchina. Translated from Zhur. Eksptl'. i Teoret. Fiz. 28, 28-37(1955). 12p.

The dispersion properties of plasma are investigated in various special cases. It is shown that the motion of ions is of great importance in most cases of propagation of longitudinal waves in discharge tubes. Values are found for the spatial period and logarithmic decrement as functions of the parameters of the discharge. (auth)

11289 AEC-tr-2620
ACTIVATION ENERGY OF HYDROGEN ION DISCHARGE AND THE THEORY OF A DELAYED DISCHARGE. O. M. Poltorak. Translated from Zhur. Fiz. Khim. 28, 1845-53(1954). 12p.

In the usual theoretical calculation of the activation energy of metals with high overvoltage, the basic assumption of the retarded discharge theory is made. This assumption is shown to be incorrect. (D.E.B.)

11290 AEC-tr-2622
CONCERNING THE DURATION OF DISCHARGE IN LIQUID INSULATING MATERIALS. I. E. Balygin. Translated from Zhur. Tekh. Fiz. 24, 337-47(1954). 10p.

Oscillograms from experiments designed to indicate the nature of breakdown in liquid dielectrics are reproduced. From these, it is concluded that discharge duration does not depend on spark gap length between 0.75 and 6 cm. The average discharge time was $\sim 10^{-7}$ sec. (D.E.B.)

11291 AEC-tr-2628
GENERATION OF ELECTROMAGNETIC OSCILLATIONS BY MEANS OF A TRAVELING-WAVE TUBE WITH AN EXTERNAL SPIRAL. V. S. Mikhalevskiĭ (Mikhalevsky) and D. N. Venerovskiĭ (Venerovsky). Translated from Zhur. Tekh. Fiz. 25, 812-16(1955). 6p.

The results of the experimental investigation of the generation of electromagnetic oscillations by a traveling-wave tube with an external spiral, and its dependency upon the geometric parameters of the spiral and the operating regime of the tube are reported. (auth)

11292
THE RUSSIAN CONTROLLED THERMONUCLEAR EXPERIMENTS. P. C. Thonemann (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Power 1, 169-72(1956) Aug.

In a recent lecture at Harwell, Academician Kurchatov of Moscow presented a paper discussing the possibilities of a controlled thermonuclear reaction in a high current gas discharge. Some of the conditions necessary for the achievement of an efficient fusion reactor are qualitatively reviewed and the Russian experiments are discussed in the light of these conditions. It is concluded that the Russian work is a first step on the long road to controlled thermonuclear power, but extension of these experiments to higher powers cannot lead to a practical solution. The scientific results however, are of great interest and may lead to a better understanding of the mechanism of cosmic ray production. (auth)

11293

GENERAL PROBLEMS OF THE CONTROLLED THERMONUCLEAR PROCESS. Edward Teller (Univ. of California, Livermore). Nuclear Sci. and Eng. 1, 313-24(1956) Aug.

Thermonuclear reactions under steady-state conditions are considered in order-of-magnitude terms. Energy loss by radiation and the transfer of energy between nuclear and electrons are also discussed. It is pointed out that the principal problem is constructing a suitable "magnetic bottle" in which nuclei of a dilute, completely ionized gas (e.g., H^2,H^3) at a temperature $\sim 10^8$ °K can be confined and reacted before losing too much energy to the walls. The practical confinement of the plasma, involving substantial hydromagnetic difficulties, can probably be accomplished, although it appears to be perhaps decades in the future. Potential advantages of a thermonuclear reactor over a fission reactor include: virtually inexhaustible fuel supply available, fuel reprocessing unnecessary, no chain reaction run-away hazard present, and direct conversion of thermonuclear energy to electrical energy may be possible. (auth)

11294

THEORY OF PLASMA RESONANCE. P. A. Wolff (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 103, 845-50(1956) Aug. 15.

Starting from the Boltzmann transport equation, a formula is derived for the rate of change of electron density in a gas plasma. With its aid a study is made of the oscillations of electron density (about the steady state value) in a discharge confined between parallel plates. The oscillations are described in terms of a set of normal modes characteristic of the plasma under study. An expression is obtained for the impedance of the discharge as a function of frequency: for the one case calculated in detail, this formula gives a resonance in power absorption at a frequency of 0.7 of the plasma resonance frequency corresponding to the central electron density. (auth)

ELECTRONS

11295 AEC-tr-2617

THE VELOCITY DISTRIBUTION OF ELECTRONS IN THE PRESENCE OF A VARYING ELECTRIC FIELD AND A CONSTANT MAGNETIC FIELD. V. M. Fain. Translated from Zhur. Eksptl'. i Teoret. Fiz. 28, 422-30(1955). 15p.

The function of the velocity distribution of electrons in a varying electric field and a constant magnetic field is found. Two cases are examined: a harmonic electric field; and an amplitude-modulated electric field. (auth)

11296

THE PROBLEM OF THE RADIATION OF ULTRA HIGH VELOCITY ELECTRONS MOVING IN A CONSTANT MAGNETIC FIELD. A. A. Sokolov and A. N. Matveev (Moscow State Univ.). Soviet Phys. JETP 3, 105-12(1956) Aug. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 126-35(1956) Jan. (In Russian)

As a further development of researches on the quantum theory of the "luminous" electron, a formula has been obtained for the differential spectrum of radiation which is uniformly valid for any spectral range, for the comparatively small energies of the radiating electron, $E \ll E_{\frac{1}{2}} = mc^2(2Rmc/3h)^{\frac{1}{2}}$ as well as for energies $E \sim E_{\frac{1}{2}}$ and $E \gg E_{\frac{1}{2}}$. A closed formula for the total radiation energy (valid for arbitrary energies of the radiating electron) and a formula for the "critical" radiation frequency of the "luminous" electron have also been obtained. (auth)

11297

THE THEORY OF THE ELECTRON FIELD MASS IN THE PRESENCE OF AN EXTERNAL MEDIUM. A. A. Sokolov and V. N. Tsytovich (Moscow State Univ.). Soviet Phys. JETP 3, 94-7(1956) Aug. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 136-40(1956) Jan. (In Russian)

Examination is made of the field correction to electron mass caused by an external medium. Second-order perturbation theory is used in the calculations. (auth)

11298

INFLUENCE OF QUANTUM RADIATION FLUCTUATIONS ON THE TRAJECTORY OF AN ELECTRON IN A MAGNETIC FIELD. A. A. Kolomenskii and A. N. Lebedev (P. N. Lebedev Physical Inst., U.S.S.R.). Soviet Phys. JETP 3, 130-2(1956) Aug. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 205-7(1956) Jan. (In Russian)

11299

PROPERTIES OF ATOMS UNDER EXTREMELY HIGH PRESSURES. A. F. Kapustinskiĭ (Mendeleev Inst. of Chem.-Technology). Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk, 427-34(1956) Apr. (In Russian)

Under extremely high pressures the valence electrons of the elements drop into empty (but permissible by Pauli) deep energy levels leading to the "destruction" of normal chemical properties of atoms and to the transformation of the order in the periodic system. This reaction is followed by the "crushing" of electron shells and "generalization" of electrons, which results in total elimination of chemical differences between the atoms and in formation of the universal metallic state. Thermodynamic, quantum-chemical, and seismographic studies support the above theory. A hypothesis was offered correlating the zonal structure of the earth sphere and the physico-chemical properties of geochemical electron shells. (R.V.J.)

GASES

11300 AEC-tr-2599

OPTICAL PROPERTIES OF GASES AT HIGH TEMPERATURES AND ULTRA-HIGH PRESSURES. Yu. N. Ryabinin, N. N. Sobolev, A. M. Markevich, and I. I. Tamm. Translated from Zhur. Eksptl'. i Teoret. Fiz. 23, 564-75(1952). 13p.

A study is made of the luminosity of A heated to a temperature of some thousands of degrees by adiabatic compression. It is found that the observed line and band spectra are basically due to radiations from N_2, occurring as a contamination in the A, and from NO and OH, formed during the adiabatic compression from impurities in the A. As the density and temperature of the gas are increased, the intensity of the continuous spectrum increases more rapidly than that of the discrete spectrum. It is shown that in the ultraviolet region the distribution of energy in the continuous spectrum can be described by Wien's formula with a unique color temperature. The color temperature of the A is measured in its dependence on the compression for pressures from 2000 to 5500 kg/cm^2 and temperatures from 4000 to 9000°. (auth)

11301

CHARGE EXCHANGE CROSS SECTIONS OF HYDROGEN IONS IN GASES. P. M. Stier and C. F. Barnett (Oak Ridge

National Lab., Tenn.). Phys. Rev. 103, 896-907(1956) Aug. 15.

Measurements are reported of the cross section for electron capture (σ_{10}), electron loss (σ_{01}), and electron detachment (σ_{-10}) for hydrogen atoms and ions traversing several gases, (σ_{1f} represents the cross section for charge transfer from initial state i to final state f.) The kinetic energy of the particle was from 3 kev to 200 kev. The target gases used were H_2, He, N_2, O_2, Ne, and A. Cross sections were determined by measuring the attenuation of the hydrogen beam in a gas cell under the influence of an electrostatic or magnetic field. The fraction of the beam in each charge state after passing through a "thick target" was also determined. This latter measurement served as a test for internal consistency of the data, since the fraction is relatable to the cross section for entry to and exit from the charge state. The loss cross section, σ_{01}, increased monotonically at low energies, reaching a maximum at a velocity approximately equal to the orbital electron velocity. For the higher energies studied the capture cross section could be represented by an expression of the form, $\sigma = Ae^{-bv}$, where A and b are constants for each gas studied. The electron attachment cross section, σ_{0-1}, was of the order 10^{-17} cm^2/gas atom for the gases studied and attained a maximum between 5 and 20 kev. The inverse transition, σ_{-10}, was approximately 10^{-15} cm^2/gas atom in the energy range studied. (auth)

11302

NICKEL DIFFUSION LEAK FOR HYDROGEN: ADDENDUM. E. R. Harrison and L. C. W. Hobbis (Atomic Energy Research Establishment, Harwell, Berks, England). Rev. Sci. Instr. 27, 332(1956) May. (cf. NSA 9-3440)

A number of these leaks have now been used and in all cases have proved satisfactory and trouble-free. (W.L.H.)

11303

VALVE FOR GAS SERVICE TO 50,000 PSI. R. L. Mills (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 27, 332-5(1956) May.

A design is presented for a high-pressure gas valve. The valve was pressure tested with oil at 50,000 psi and was proof tested with He at a pressure of 30,000 psi. The low- and high-pressure closures proved to be absolutely tight and after many openings and closings the valve seat showed no wear. (W.L.H.)

INSTRUMENTS

11304 NP-6081

Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

QUARTERLY PROGRESS REPORT NO. 42 FOR PERIOD ENDING MAY 31, 1956. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. July 15, 1956. 113p. Project 102B. Contract DA-36-039-SC-64637.

Detailed reports of progress made in research are presented on physical electronics, microwave spectroscopy, nuclear magnetic resonance, hyperfine structure, microwave electronics, statistical communication theory, and communications biophysics. Brief summaries of the progress on atomic beams, transistor circuits, noise in electron devices, low temperature physics, microwave gaseous discharges, sensory replacement and circuit theory. (For preceding period see NP-6012.) (W.L.H.)

11305 UTIA-TN-5

Toronto. Univ. Inst. of Aerophysics.

THE HOT-WIRE ANEMOMETER AND ITS USE IN NON-STEADY FLOW. Ian J. Billington. Sept. 1955. 75p. (AD-82512).

The heat loss equations commonly applied in hot-wire anemometry are discussed and some experimental results are presented for the heat loss of a hot-wire in a stationary gas. Hot-wire probe design and calibration procedures are discussed and the design of an open-jet low-turbulence calibration tunnel is described. The sensitivity of the hot-wire to small fluctuations is considered and the limitations to the frequency response imposed by the finite thermal lag of the wire are pointed out. Commonly used methods of overcoming the thermal lag effects are discussed. The use of hot-wires in non steady shock tube flows is considered and experimental photographs are included to illustrate typical results. Procedures for the reduction of shock tube results are outlined and a correction for the finite impedance of the heating current source is developed. (auth)

11306

SIMPLIFIED RADIO-FREQUENCY ION SOURCE. S. K. Allison and E. Norbeck, Jr. (Univ. of Chicago). Rev. Sci. Instr. 27, 285-8(1956) May.

The quartz or glass sheathed cylindrical cathode probe of the conventional rf ion source has been eliminated. The conventional glass pad electron beam "back stop" has been replaced by nonfracturing porcelain. Commercial Pyrex pipe has been used in the construction of the glass thimble in which the plasma is formed, and the thimble sealed to the base with O-ring pressure seals. The anode probe is removable for ease in cleaning. The source produces 300 μa of H^+; it also produces 200 μa of He^+, and at low operating gas pressures, usable amounts of He^{++}, as large as a few tenths of a percent of the He^+ output. (auth)

11307

NEGATIVE HYDROGEN ION SOURCE. J. A. Weinman and J. R. Cameron (Univ. of Wisconsin, Madison). Rev. Sci. Instr. 27, 288-93(1956) May.

A negative hydrogen ion source has been built which will yield from 25 to 30 μa of H^- ions focused on a $\frac{1}{4}$-inch diameter spot. This is accomplished by first producing positive ions in a magnetic ion source. These ions are extracted and accelerated by at most 17.5 kv. The ions then pass through an electron pickup capillary tube into the center of which the electron donating gas is introduced. The H^- ions emerging from this tube are accelerated by an additional 20 to 30 kv while the emerging secondary electron are electrostatically repelled. The negative ions are then focused by an electrostatic "saddle field" lens and magnetically analyzed. An Evapor-ion pump is used to maintain the pressure in the ion source container less than 10^{-4} mm Hg. (auth)

11308

SIMULTANEOUS MEASUREMENTS OF DENSITY, VISCOSITY, AND ELECTRIC CONDUCTIVITY OF MELTS. J. D. Mackenzie (Princeton Univ., N. J.). Rev. Sci. Instr. 27, 297-9(1956) May.

An apparatus is described for the simultaneous measurements of density, viscosity, and electric conductivity of ionic liquids at high temperatures. Density is simply measured by the suspension of a platinum bob in the melt contained in a platinum crucible situated inside a vertical tube furnace. The bob is suspended by a platinum wire attached to one arm of an analytical balance. Upward or downward motion of the bob in the melt is produced by changing the weights on one pan of the balance. The velocity of the bob, directly dependent on the viscosity of the melt, is calibrated against a standard liquid from 10 to 10,000 poise. By using the suspension and the crucible as the two electrodes, the apparatus becomes a conductance cell. The corrections in density measurements due to surface tension are eliminated by the use of two bobs of different dimensions but similar suspension wires. This furnishes not only duplicate viscosity results

but also two cell-constants for electric conductance. Vacuum fusion is possible in the same apparatus. (auth)

11309

HIGH-TEMPERATURE VACUUM FURNACE FOR TENSILE TESTING. E. A. Smith and R. W. Guard (General Electric Research Lab., Schenectady, N. Y.). Rev. Sci. Instr. 27, 386-7(1956) June.

A resistance furnace using a tantalum tube heater has been constructed for tensile testing wire specimens of metals that require protection from the atmosphere, at temperatures up to 1600°C. Specimens of molybdenum and tungsten have been successfully tested in the range from 1000° to 1600°C. (auth)

11310

MULTIPLE TARGET NUCLEAR MAGNETIC RESONANCE CRYOSTAT. N. Fuschillo (Pennsylvania State Univ., University Park). Rev. Sci. Instr. 27, 394-6(1956) June.

A cryostat is described for accurately controlling the temperatures to 0.1°K of several solid specimens during nuclear magnetic resonance experiments in the temperature range from 10 to 400°K. The specimen targets are passed through the rf coil of the spectrometer in succession. This procedure enables more certain comparisons to be made of line shapes for different samples. The method is of particular advantage when small changes are to be observed or when it is of importance to have the individual specimens undergo thermal treatments as similar as possible. Also, since several samples can be studied in succession at any desired temperature a considerable saving of time is achieved. The cryostat is designed so that solid or liquid specimens can be utilized with a minimum of disturbance to existing adjustments. (auth)

11311

BREAKDOWN PROTECTION WITH A LOCKED GRID THYRATRON. Stewart M. Krakauer (Columbia Univ., New York). Rev. Sci. Instr. 27, 414-15(1956) June.

Protection is approached by minimizing the initial discharge intensity, and causing this event to remove the applied voltage before any subsequent discharges can occur. This condition is very simply and effectively brought about by connecting a high value of resistance (1 to 10 meg) in series with the grid. Positive ion current will then tend to drive the grid positive relative to the cathode, whereupon electrons will be drawn from the cathode in sufficient quantity to maintain the grid near cathode potential. The grid voltage remains "locked" to that of the cathode and will be independent of driving signal. (W.L.H.)

11312

MULTICHANNEL SYSTEMS FOR PULSE-HEIGHT AND TIME-OF-FLIGHT ANALYSIS. H. L. Schultz, G. F. Pieper, and L. Rosler (Yale Univ., New Haven, Conn.). Rev. Sci. Instr. 27, 437-45(1956) July.

Multichannel systems for pulse-height and time-of-flight analysis based on the original development of Hutchinson and Scarrott are described. The equipment can be divided into three basic categories: A time channel analyzer using serial storage and arithmetic operations. This unit provides approximately 500 2-μsec time channels each having a capacity of 10 binary digits. It is now being used for slow neutron time-of-flight spectroscopy. A pulse-height-to-time converter which when used in conjunction with the above or similar unit forms a multichannel pulse-height analyzer with 200 useful channels. Data display systems of two types, one for continuous visual monitoring and one for permanent recording in chart form. (auth)

11313

DEVICE FOR APPLYING COMPRESSION TO SMALL CRYSTALS. Eugene J. Rapperport (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instr. 27, 446-7(1956) July.

The design of an apparatus for applying uniaxial compression to specimens with cross sections up to $\frac{1}{4}$ in.^{2} is described. One feature of the apparatus is the construction of the force transmitting linkage. This linkage was designed to minimize the transmission of shear forces, and thus to avoid bending moments on the samples. The apparatus enables the compressive forces acting on the samples to be determined to within 0.1%. (auth)

11314

NONBLOCKING DOUBLE-LINE LINEAR PULSE AMPLIFIER. Edward Fairstein (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 27, 475-82(1956) July.

A linear amplifier with a 1.2-μsec clipping time and a gain of 50,000 suitable for scintillation spectrometry is described. Low-energy photoelectric peaks can be resolved under conditions in which the unwanted background has a rate in excess of 1000,000 cps and has components 40 times more energetic than the desired spectrum. No shift in the energy axis is observed under these conditions. The amplifier consists of a White cathode follower preamplifier, three feedback groups, and a White cathode follower output stage. Each of the three feedback groups contains four stages, three of which are amplifiers. Blocking is eliminated by the use of grid resistors low in value compared to the preceding stage plate load resistors. This feedback group configuration is also more linear by an order of magnitude than the conventional configuration. It is shown how RLC coupling between White cathode follower halves can conserve power supply voltage. It is shown how a cable correctly terminated at the transmitting end rather than at the receiving end can eliminate the difficulties usually associated with the use of a long cable between preamplifier and main amplifier. (auth)

11315

EFFECT OF DRIVING PULSE SHAPE ON THE PERFORMANCE OF A SCHMITT TRIGGER CIRCUIT. Edward Fairstein (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 27, 483-4(1956) July.

It is shown that the optimum pulse shape for driving a Schmitt trigger circuit is one in which the peak of the pulse occurs near the leading edge, followed by a linear decay to the trailing edge. The magnitude of the decay should be less than the trigger hysteresis. The circuit for obtaining such a pulse shape is shown. (auth)

11316

HELIUM-COOLED LIQUID HYDROGEN–DEUTERIUM TARGET. G. S. Janes, L. G. Hyman, and C. J. Strumski (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instr. 27, 527-30(1956) July.

A thin-walled liquid hydrogen-deuterium target has been developed which makes use of the boil-off vapors from liquid helium as a coolant. Approximately three liters of liquid helium are required to condense the hydrogen and 0.13 liter per hour thereafter. (auth)

11317

IMPROVED DIFFERENTIAL PULSE-HEIGHT SELECTOR CIRCUIT. Edward Fairstein (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 27, 549(1956) July.

Three changes are made in the integral-differential pulse-height selector circuit. A review of the modified circuit operation is given. (T.R.H.)

11318

PRECISION MEASUREMENT OF DETONATION VELOCITIES IN LIQUID AND SOLID EXPLOSIVES. A. W. Campbell, M. E. Malin, T. J. Boyd, Jr., and J. A. Hull (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 27, 567-74(1956) Aug.

A versatile chronographic technique for the measurement of detonation velocities in liquid and solid explosives is

discussed. A raster-type oscilloscope is described which has a sweep linearity of 1% and a time coverage of 300μsec. This instrument is composed of standard electronic components and requires relatively little maintenance. The basic signal mixing circuits used to generate fast-rising pulses associated with the detonation of an explosive charge are briefly described. Some electrical effects associated with the detonation of an explosive charge are briefly described to point out a possible source of spurious signals. Techniques for the preparation and assembly of explosive charges are presented together with certain precautions which must be taken against the possibility of the generation of false signals. The effect of temperature on detonation velocities of liquid and solid explosives is mentioned. Using the techniques and precautions described, it is possible to obtain detonation velocity data with a precision of 0.1% or better. (auth)

11319

CALCULATOR FOR SOME rf PROBLEMS IN ACCELERATOR DESIGN. K. R. MacKenzie (Univ. of California, Los Angeles). Rev. Sci. Instr. 27, 580-3(1956) Aug.

A simple mechanical calculator has been developed for solving the transmission line equations when the characteristic impedance is a variable. The speed of computation is some two orders of magnitude faster than analytical methods. The theoretical basis is described and also the way in which it can be used. Some representative problems, which have benefited by use of the calculator, are discussed. (auth)

11320

USE OF SERVOMECHANISMS IN THE COMPENSATION OF A 70-MV X-RAY BEAM. David L. Dye (Univ. of California School of Medicine, San Francisco). Rev. Sci. Instr. 27, 584-8(1956) Aug.

The naturally peaked x-ray beam from the 70-Mev synchrotron has been collimated and compensated to flatness by differential absorption in a copper filter. Angulation of the synchrotron magnet produces a shift of the filter support with respect to the x-ray beam, thus altering the compensation achieved before angulation. This paper contains a description of a system of two servomechanisms which senses the change in compensation and provides correcting motions to restore proper filter position. Particular emphasis is given to items of technique which contributed to the success of this development. (auth)

11321

NONLINEAR AMPLIFIER DESIGN FOR PULSE-HEIGHT ANALYZERS. G. W. Hutchinson (Univ. of Glasgow, Scotland). Rev. Sci. Instr. 27, 592-6(1956) Aug.

The ratio of maximum to minimum pulse sizes which can be simultaneously recorded by a kick sorter is limited by the curvature of the characteristic of its biased amplifier over a finite region of input potentials. The extent of this region can be reduced from a few volts to about 10 millivolts by including the nonlinear elements of the amplifier in its negative feedback loop. An amplifier is described which embodies this principle and also provides a discriminator and gate circuit. (auth)

11322

RECORDING MAGNETIC-RESONANCE SPECTROMETER. M. W. P. Strandberg, M. Tinkham, I. H. Solt, Jr., and C. F. Davis, Jr. (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instr. 27, 596-605(1956) Aug.

Apparatus especially designed for studying electron paramagnetic resonance is described and discussed. A magnet of novel yokeless design is presented. Field stabilization and modulation procedure is considered. The microwave sample cavity is analyzed to determine conditions for optimum operation. The klystron stabilization problem is examined. Appropriate lumped circuits for low-frequency operation are described. The signal amplification and presentation system is treated in detail. (auth)

11323

FILAMENTARY SUBMINIATURE SCALERS. C. C. Harris and P. R. Bell (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 27, 608-10(1956) Aug.

In order to reduce the power requirements and heat dissipation in multichannel pulse-height analyzers with parallel digital storage, we have devised and tested a low-wattage scale-of-two employing filamentary subminiature tubes. These units are designed for use in scales of 16 or 32 and exhibit great reliability and long life. The resolving time is 5 μsec with grid-catching diodes and 13 μsec unaided. For greater reliability in very long cascades and for battery operation, a Higinbotham version has been devised. Both designs promise extremely long life and may be useful wherever bistable switching circuits are used. (auth)

3324

COMPUTERS—THEIR OPERATION AND APPLICATIONS. Edmund Callis Berkeley and Lawrence Wainwright. New York, Reinhold Publishing Corp., 1956. 366p.

The basic information on automatic digital and analog computing machines is reviewed. Included are topics such as memory units, arithmetic units, control units, programming, reliability, advantages, and error control. Other types of automatic computing machines and training computers are briefly considered. Possible applications of automatic computing machines are listed. (B.J.H.)

11325

A VERSATILE PORTABLE AIR SAMPLER. H. S. Jordan and R. N. Mitchell (Los Alamos Scientific Lab., N. Mex.). Am. Ind. Hyg. Assoc. Quart. 17, 303-4(1956) Sept.

A dependable high vacuum portable air sampler with means for positioning the sampling head is described in detail. The description would enable the average small shop to fabricate the unit without undue difficulty. The sampler has been in successful use over a period of twelve months. (auth)

11326

FAST DIFFERENTIAL ANALYZER. Harold A. Lamonds (North Carolina State Coll., Raleigh). Nucleonics 14, No. 8, 86-90(1956) Aug.

A single-channel pulse-height analyzer is described. A schematic diagram is shown, and a description of the operation is given. (W. L. H.)

11327

HIGH RESOLUTION MILLIMICROSECOND TIME INTERVAL MEASUREMENTS BASED UPON FREQUENCY CONVERSION. C. Cottini, E. Gatta, and G. Giannelli (Laboratori CISE, Milan). Nuovo cimento (10) 4, 156-7(1956) July.

A brief description is given of a time interval measuring system in which each of the two pulses, whose interval is to be measured, excites a different high-frequency Q oscillating circuit. The two damped oscillations are mixed in a germanium diode ring demodulator. Its output is a damped low-frequency oscillation whose phase is equal to the phase difference between the two damped high-frequency oscillations. (B.J.H.)

Refer also to abstract 11491.

ISOTOPES

11328 AECU-3144

Rensselaer Polytechnic Inst., Troy, N. Y.

A TABLE OF RADIONUCLIDES ARRANGED ACCORDING TO HALF-LIFE. Herbert Mottram Clark and Donald Emmett Neil. Dec. 1955. 226p. $1.25(OTS).

Essentially a revision of MonC-400, prepared by Clinton Labs.

11329 ORNL-2141

Oak Ridge National Lab., Tenn.

CATALOG OF THE ISOTOPES OF THE HEAVY ELEMENTS. J. A. Martin, F. N. Case, and V. O. Haynes. Sept. 20, 1956. 18p. Contract W-7405-eng-26. $0.20 (OTS).

This catalog lists the available amounts and the purity of the isotopes of U, Th, and Pu which have been separated electromagnetically and U^{233} and Am^{241} which have been separated chemically from reactor-irradiated materials. (auth)

11330

INDUSTRIAL UTILIZATION OF RADIOISOTOPES—1946-56. A Forum Survey. Edwin Wiggin and Elaine Gladstone, eds. New York, Atomic Industrial Forum, Inc., 1956. 129p. $2.50.

A survey is presented of all industrial organizations licensed by AEC from the beginning of the isotope distribution program to the cut-off date of the tabulation. It also includes details on all licenses issued except those of a company-confidential nature. (W. L. H.)

11331

PRODUCTION OF CARRIER-FREE COBALT-58 BY PILE IRRADIATION OF NICKEL. C. E. Mellish and J. A. Payne (Atomic Energy Research Establishment, Harwell, Berks, England). Nature 178, 275-6(1956) Aug. 4.

ISOTOPE SEPARATION

11332

A COUNTERCURRENT GASEOUS DIFFUSION PROCESS; THEORY OF THE SEPARATION AT EQUILIBRIUM. Juan A. McMillan (Comisíon Nacional de la Energía Atómica, Buenos Aires, Argentina). Z. Naturforsch. 11a, 284-5(1956) Apr. (In English)

An experimental device for the obtention of a gaseous diffusion countercurrent process is proposed. The theory of the separation at equilibrium for a binary isotopic mixture is developed on the basis of the transport up the tube, the total and the desired molecules transverse transport. The solution is given for any value of the relative abundances. (auth)

MASS SPECTROGRAPHY

11333

SMALL GENERAL PURPOSE CYCLOIDAL-FOCUSING MASS SPECTROMETER. Charles F. Robinson and Lawrence G. Hall (Consolidated Electrodynamics Corp., Pasadena, Calif.). Rev. Sci. Instr. 27, 504-8(1956) July.

A mass spectrometer employing a cycloidal-focusing mass resolving system is described. The mass analyzer proper, including the magnet and a high-speed continuous-flow inlet system, weighs approximately 70 lbs. The resolving system shows good mass resolving power, sensitivity, and analytical accuracy up to about mass 150 amu, and adequate service life. The mass resolving power can be extended substantially in cases where some loss of sensitivity and analytical accuracy is tolerable. (auth)

11334

NONUNIFORM FIELDS IN CYCLOIDAL-FOCUSING MASS SPECTROMETERS. Charles F. Robinson (Consolidated Electrodynamics Corp., Pasadena, Calif.). Rev. Sci. Instr. 27, 509-12(1956) July.

In a cycloidal-focusing mass spectrometer, nonuniformities in the magnetic and electric fields may cause either an actual deterioration of the image quality or merely a shift in the focal point. The latter effect is the more usual one and it can be compensated easily. (auth)

11335

SPACE CHARGE IN CYCLOIDAL-FOCUSING MASS SPECTROMETERS. Charles F. Robinson (Consolidated Electrodynamics Corp., Pasadena, Calif.). Rev. Sci. Instr. 27, 512-13(1956) July.

In a curtate-cycloidal-focusing mass spectrometer, the first-order effect of space charge is not to impair the quality of the focus but to shift the focal point out of the plane of the resolving slit. For a given ion mass and ion current, the magnitude of the effect is about four times as large in a cycloidal-focusing instrument as in a 180° magnetic sector mass spectrometer operating in the same magnet. (auth)

11336

MASS SYNCHROMETER. Lincoln G. Smith and C. C. Damm (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 27, 638-49(1956) Aug.

A novel mass spectrometer with which masses of ions are determined in terms of high harmonics of their cyclotron frequencies is described from both experimental and theoretical viewpoints. Half-width resolution is adjustable electrically over a range of values presently between 10,000 and 25,000 at all mass numbers below 250. By means of a highly precise technique of matching peaks, relative doublet separations in frequency ($\Delta f/f$) exactly equal to those in mass ($\Delta M/M$) are determined with great ease and accuracy on a ratio scaler. Masses have been determined with an accuracy of better than one part in 10^7, which is comparable with the best yielded by conventional instruments. Measurements should be of particular importance, even if of no greater precision than others, because the very different techniques employed make unlikely the occurrence of unsuspected systematic errors of the same nature as in other work. Sources of systematic error are discussed. It is believed that most of these have been eliminated, though avoidance of the not uncommon errors caused by differences in orbit distributions in doublets involving ions formed by dissociation has so far led to such large reductions of intensity as to restrict greatly the number of such important doublets for which reliable data have been obtainable. The synchrometer is apparently at a disadvantage to some deflection-type spectrometers in the matter of intensity, to some extent in principle and to a greater extent (to date) in practice. This disadvantage is enhanced by the difficulties of using an electron multiplier for detecting ions in strong magnetic fields. It is believed that the latter difficulties are not insuperable and it seems reasonable to expect that further work on increasing the intensity and improving the focusing of ions from the source will greatly enhance the number of results obtained. The possibilities of using the instrument for analytical purposes are interesting but so far largely unexplored. (auth)

11337

THE EFFECT OF THE RESIDUAL GAS PRESSURE UPON THE SPACING OF MASS SPECTROSCOPIC DOUBLETS. Neil R. Isenor, G. Ronald Bainbridge, Philip C. Eastman, and Henry E. Duckworth (National Research Council of Canada, Ottawa). Can. J. Phys. 34, 993-5(1956) Sept.

Some confirmation of the fact that retardation of high velocity ions by gases depends upon the nature of the ions is offered. The problem is to be further investigated with a new 9-ft. semicircular mass spectrometer. (T.R.H.)

MATHEMATICS

11338 AD-88538

Institute for Advanced Study, Princeton, N. J.

APPROACHES TO THE THEORY OF DISTRIBUTIONS.

J. C. Burkill. Jan. 1956. 17p. DA Project 5B99-01-004. Contract DA-36-034-ORD-1622.

A new approach to the theory of distribution is discussed, and a theorem is presented and proved. (W.L.H.)

11339 WADC-TN-55-249

Carnegie Inst. of Tech., Pittsburgh.

A COMPARISON OF TESTS ON THE MEAN OF A LOGARITHMICO NORMAL DISTRIBUTION WITH KNOWN VARIANCE. Edwin G. Olds and Norman C. Severo. Dec. 1955. 64p. Project title: RESEARCH ON TRANSFORMATIONS IN THE ANALYSIS OF VARIANCE.

Three test procedures are considered for testing an hypothesis on the mean of a logarithmico-normal distribution with known variance. The first is a normal theory test applied to the logarithms of the original data; the second is a normal theory test applied to the original data; and the third is a test based on the Neyman-Pearson Lemma. The operating characteristics of these tests are developed and some asymptotic properties obtained. It is found that the three procedures give quite different results unless the mean under the null hypothesis is large relative to the standard deviation. (auth)

11340 WAPD-SR-506(Vol. I)

New York Univ., New York. Atomic Energy Commission Computing Facility and David W. Taylor Model Basin. Applied Mathematics Lab., Carderock, Md.

A TABLE OF THE INTEGRAL

$$\phi(x,t) = \frac{1}{2\sqrt{\pi t}} \int_{-\infty}^{\infty} \frac{e^{-\frac{(x-y)^2}{4t}}}{1+y^2}\, dy.$$

VOLUME I. M. E. Rose, W. Miranker, P. Leak, L. Rosenthal, and J. K. Hendrickson. Oct. 1954. Changed from OFFICIAL USE ONLY Dec. 21, 1955. 90p. [For] Westinghouse Electric Corp. Atomic Power Div. Contract AT-11-1-GEN-14. $0.50(OTS).

11341

NUMBER OF FEYNMAN GRAPHS AND CONVERGENCE. E. R. Caianiello (Univ. of Rochester, N. Y.). Nuovo cimento (10) 3, 223-5(1956) Jan.

Refer also to abstract 10950.

MEASURING INSTRUMENTS AND TECHNIQUES

11342 AERE-EL/L-7

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England].

LECTURE ON ERROR AND CORRECTION IN COUNTER WORK, COUNTER EFFICIENCY, AND SOURCE GEOMETRY. R. K. Barnes. [nd]. 10p.

11343 AF-SAM-56-15

Texas. Univ., Austin. Radiobiological Lab.

A HALOGENATED HYDROCARBON-DYE WATER EQUIVALENT METHOD FOR MEASURING X- AND GAMMA RADIATION. Sanford C. Sigoloff. Mar. 1956. 5p.

11344 DP-51

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

A TRAVELING MONITOR FOR AN EXPONENTIAL PILE. L. M. Johnson. Oct. 1955. 15p. Contract AT(07-2)-1. $0.20(OTS).

A traveling monitor was constructed for use in the exponential pile of the Savannah River Laboratory. This instrument plots neutron flux distribution by simultaneously recording the current output and the vertical position of a motor-driven ion chamber. (auth)

11345 NYO-6628

Carnegie Inst. of Tech., Pittsburgh.

A METHANE PROPORTIONAL COUNTER SYSTEM FOR NATURAL RADIOCARBON MEASUREMENTS (thesis). Ward Diethorn. Mar. 16, 1956. 157p. Contract AT(30-1)-844.

A method is presented for measuring natural C^{14} by converting the carbon to CH_4 and counting it in a proportional counter. The CH_4 is prepared from carbonaceous material by burning to CO_2 and then reducing the C with Mg at 600°C. Aluminum carbide is made by heating at powder in a high-temperature furnace and methane is then generated by reaction of the carbide with water. (W.L.H.)

11346 ORINS-14

Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.

THYROID UPTAKE CALIBRATION. I. MOCK-IODINE, A RADIOACTIVE IODINE GAMMA-RAY STANDARD. Marshall Brucer, T. H. Oddie, and James S. Eldridge. July 25, 1956. 96p. Contract AT-40-1-GEN-33. $0.50 (OTS).

The necessity for a method of intercalibrating thyroid radioiodine uptake measurements is explained. A method has been devised in which mock-iodine, a mixture of Ba^{133} and Cs^{137}, replaces I^{131} for purposes of gamma-ray measurement. The mock-iodine has a useful life of 10 to 15 years whereas I^{131} has a half life of 8 days. The gamma-ray spectra of various mixtures of mock-iodine are matched with I^{131}. The method of making and calibrating extended sources is explained. An appendix gives detailed data on the various spectra. The beginnings of a program of intercalibration are presented. It is concluded that mock-iodine can be used for I^{131} gamma-ray calibration within 5 per cent accuracy. (auth)

11347 TT-630

GAMMA SPECTROSCOPY USING COMPTON ELECTRONS. (O γ-Spektroskopii po Komptonovskim Elektronam). B. T. Dzhelepov and M. L. Orbeli. Translated by G. Belkov from Doklady Akad. Nauk S.S.S.R. 62, 615-17 (1948). 6p.

An instrument for the study of γ spectra by measurement of Compton electrons was constructed and tested. Specifications for construction are given. (W.L.H.)

11348

DETECTION OF CHARGED PARTICLES WITH GAS SCINTILLATION COUNTERS. Ralph A. Nobles (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 27, 280-3(1956) May.

A study has been made of the pulse heights obtained from α particles in a gas scintillation counter using A, Kr, and Xe. Measurements were made with an RCA-6342 photomultiplier viewing the scintillations directly and also with the aid of a quaterphenyl wavelength shifter. Pulse heights from Xe were about 10 times as great as those from A and 3.6 times those from Kr. The gain in pulse height with a wavelength shifter was about a factor of 15 for each gas. The rise time of the light pulses was of the order of one mμsec or less. Pulse height was found to be a linear function of energy for protons, deuterons and helium ions in a Xe counter with a wavelength shifter. The pulse height was independent of the type of particle producing the scintillations and depended only on the energy lost in the counter. (auth)

11349

TRITIUM SURVEY INSTRUMENTS. G. E. Driver (General Electric Co., Richland, Wash.). Rev. Sci. Instr. 27, 300-3 (1956) May.

Portable counters for the detection of surface and air tritium contamination are described. The surface monitor uses a sponge rubber seal to the surface with an argon-methane counting mixture being admitted during measure-

ments. The air monitor mixes methane with the air before counting, and is capable of detecting a tritium concentration of 10^{-5} mc/cc of air. (auth)

11350

TWO CHANNEL HOMOGENEOUS FIELD AXIAL FOCUSING PAIR SPECTROMETER. J. A. Jungerman (Univ. of California, Davis). Rev. Sci. Instr. 27, 322(1956) May.

A design is proposed for further improvement of the counting rate through the use of multiple channels from source to detector. (W.L.H.)

11351

XENON GAS SCINTILLATION FISSION COUNTER. H. Palevsky, R. L. Zimmerman, and K. E. Larsson (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 27, 323-4(1956) May.

The principal difficulty with the first gas scintillation counters was the poisoning of the gas filling, which quenched the fluorescence and made the counter inoperable unless the gas was repurified. It was found later that if the counter was operated at reduced temperature (<0°C) the poisoning was diminished. A counter has been built and is in operation that is simple to maintain and operates at room temperature with a negligible amount of poisoning. The details of construction and operation are presented. (W.L.H.)

11352

GRIDDED ION CHAMBER FOR ALPHA-PARTICLE ENERGY MEASUREMENT. Herman L. Miller (Dow Chemical Co., Denver, Colo.). Rev. Sci. Instr. 27, 330-2(1956) May.

This ion chamber is useful in situations where simplicity and ease of construction are of primary importance. It was built inside an ordinary 4 quart "mirro" household pressure cooker. It is suitable for α particles of less than 7 Mev energy. (W.L.H.)

11353

CASTING ASTROLITE CYLINDERS. Larry Oswald (Univ. of California, Berkeley). Rev. Sci. Instr. 27, 334-6(1956) May.

In cloud chamber experiments at the 184-in. cyclotron and the Bevatron it became desirable to use an alcohol-water mixture and since glass is not suitable for the cloud chamber astrolite R-250 was cast into cloud chamber cylinders. The method of casting is described in detail. (W.L.H.)

11354

FAST TIMING OF SCINTILLATION PULSES. Harold K. Ticho and Joleroy Gauger (Univ. of California, Los Angeles). Rev. Sci. Instr. 27, 354-9(1956) June.

Some modifications of the conventional chronotron circuit are discussed. Using such a modified chronotron, time interval distributions due to two liquid scintillation counters have been studied under various experimental conditions. These studies suggest that even when counters with sensitive areas of ~300 cm^2 are used, a precision of ±0.25 mμsec in an individual time interval measurement can be achieved if the distance between the particle trajectory and the photosensitive surface is known. (auth)

11355

AUTOMATIC SCANNING DEVICE. Lennart W. Holm (Nobel Inst. of Physics, Stockholm). Rev. Sci. Instr. 27, 370-4(1956) June.

The driving mechanism and the control and recording circuits of an automatic device for repeated, continuous, unidimensional scanning of radioactive objects are described. The scanner can run at several different speeds from 4.10×10^{-3} up to 1.32 mm/sec. It is shown theoretically and illustrated with actual examples that it is possible to construct "equilibrium curves," i.e., curves corresponding to an infinitely low scanning speed, from those recorded with finite scanning speeds. (auth)

11356

ZONE REFLECTION CAMERA FOR STUDYING CRYSTAL IMPERFECTIONS BY THE SCHULZ TECHNIQUE. C. T. Wei (Univ. of Illinois, Urbana). Rev. Sci. Instr. 27, 397-9 (1956) June.

An x-ray-diffraction camera for studying imperfections in single crystals by means of the Schulz technique is described. This camera provides a convenient way for aligning the crystal and for indexing the various reflections. The latter is necessary in studying the crystallography of the imperfections. Sub-boundaries and local lattice curvature with disorientation of 1 min of arc have been detected. (auth)

11357

USE OF Au–Ge BROAD AREA BARRIER AS ALPHA-PARTICLE SPECTROMETER. J. Mayer and B. Gossick (Purdue Univ., Lafayette, Ind.). Rev. Sci. Instr. 27, 407-8 (1956) June.

The use of Au–Ge broad area barriers as alpha-particle spectrometers is described. The energy of the incident alpha particles was varied by adjusting the separation between source and the Au–Ge barrier. The pulse heights corresponding to maxima in the differential counting rate have been plotted against the range of the alpha-particles penetrating the barrier. The range as a function of energy has also been plotted, and a comparison of the two sets of points indicates that the pulse heights are proportional to the energy of the incident alpha-particles. (W.L.H.)

11358

RECOIL TYPE NEUTRON SPECTROMETER FOR 0.05 TO 1 MEV. Gilbert J. Perlow (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 27, 460-7(1956) July.

A neutron energy spectrometer is described, suitable for the region 50 kev to 1 Mev. Hydrogen recoils from CH_4 in a proportional counter are collimated and enter a second counter. The sum of the pulse heights is analyzed whenever a coincidence occurs. A third counter in anticoincidence discriminates against cases in which all the energy is not lost in the first two. With the collimation used the energy spread is ~ 10% and the efficiency an approximately linear function of energy, being 10^{-5} at 180 kev. (auth)

11359

PROTON-RECOIL NEUTRON SPECTROMETER. C. H. Johnson and C. C. Trail (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 27, 468-74(1956) July.

A proton-recoil telescope with thin polyethylene radiator has been designed for neutron spectroscopy and for neutron detection with known efficiency in the energy region from about 2 to 20 Mev. Five radiator thicknesses may be chosen over this energy region. Protons recoiling near 0° from the radiator pass through two proportional counters and terminate in a NaI(Tl) crystal. Triple coincidences gate an analyzer for observing the spectrum from the crystal. A spectrum of 13.7-Mev neutrons was observed with a width at half-maximum of 5.3 and 6% background. The efficiency with this resolution at 13.7 Mev is 3.6×10^{-6}. (auth)

11360

GAS-FLOW PROPORTIONAL COUNTER FOR SOFT X-RAY DETECTION. C. F. Hendee, S. Fine, and W. B. Brown (Philips Labs., Irvington on Hudson, N. Y.). Rev. Sci. Instr. 27, 531-5(1956) July.

One of the major problems of analysis in the soft x-ray region is the limitation due to low transmission of the window materials of sealed-off x-ray detectors. This paper describes the properties and use of a gas-flow proportional counter system for the x-ray analysis of elements in the third period of the periodic table, with special reference to Al and Si. The use of gases flowing continuously through the counter at atmospheric pressure in conjunction with He also

at atmospheric pressure in the optical path permits the use of ultra-thin nonvacuum-tight windows with high transmission in this region. Comparative data, obtained on a Norelco fluorescence spectrometer, show a tenfold increase in counting efficiency for AlKα over detectors previously available for this application. (auth)

11361

NONLINEAR RESPONSE OF NaI(Tl) TO PHOTONS. D. Engelkemeir (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 27, 589-91(1956) Aug.

A study of the response of the sodium iodide scintillation counter to photons in the energy range from 10 to 1500 kev has shown the presence of a significant nonlinearity. Response curves are given for a number of crystals of different dimensions. (auth)

11362

RECORDING DECAY OF ELECTRON DENSITY IN IONIZED GASES. G. E. Deakins and C. M. Crain (Univ. of Texas, Austin). Rev. Sci. Instr. 27, 606-8 (1956) Aug.

This paper describes a method for the measurement and photographic recording of electron density loss in an ionized gas utilizing a microwave system operating near 9400 Mc. The region between initial density level (upon removal of a 24.5-Mc ionizing voltage) and 500 μsec later was investigated. Examples of results obtained for commercial neon using this method of measurement are included. In general, it was observed that for commercial neon 90% of the electron density loss occurred within the first 250 μsec after removal of the ionizing voltage. The equipment used along with photographs of the arrangement, and the results obtained are discussed briefly. (auth)

11363

LIGHT SHIFTER FOR ČERENKOV RADIATION. E. Heiberg and J. Marshall (Univ. of Chicago). Rev. Sci. Instr. 27, 618-19(1956) Aug.

Measurements are reported of the use of luminescent materials as a light shifter for Cherenkov radiation, with the object of increasing the pulse height from Cherenkov light observed by a photomultiplier tube. By this process the directional properties of the Cherenkov light are essentially lost. (auth)

11364

NEUTRON REFLECTING MIRRORS FOR DETERMINING COHERENT SCATTERING CROSS SECTIONS. C. J. Heindl, I. W. Ruderman, J. M. Ostrowski, J. R. Ligenza, and D. M. Gardner (Columbia Univ., New York). Rev. Sci. Instr. 27, 620-2(1956) Aug.

Mirrors suitable for determining coherent cross sections by the neutron reflection technique are prepared by evaporating a sample on a flat electrochemically polished vanadium plate. Samples of separated isotopes as small as 20 mg may be used. (auth)

11365

MICROSCOPE FOR LARGE NUCLEAR PLATES. G. T. Zorn (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 27, 628-30(1956) Aug.

A precision microscope which may be used with all sizes of nuclear plates up to 10 × 16 in. has been constructed. Its simplicity of construction, and flexibility and ease of use recommend its general design. (auth)

11366

PHOTOMETRIC IONIZATION MEASUREMENTS IN A MULTIPLATE CLOUD CHAMBER. David O. Caldwell and Yash Pal (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instr. 27, 633-8(1956) Aug.

A method has been developed for determining photometrically the ionization of multiplate cloud chamber tracks. A simple, projection type of photometer is used to measure the track opacity, from which the ionization of the track is obtained by comparison with the opacity of a track of known ionization. The ratio of the properly normalized opacities of the two tracks is related to the ratio of their ionizations by a simple power law. The technique has been employed, with geometric residual range determinations, to find particle masses. It also has been used, when the mass is known, to ascertain the residual range in the plate in which a particle stops. By determining both the ionization and the change in ionization occurring in a plate traversal, both the mass and the residual range of particles have been found. Specific applications include a determination of the range of the secondaries from $K_{\mu 2}$ and $K_{\pi 2}$ decays, and a measurement of the mass of a particle which releases more than 1.6 Bev on stopping. The latter is found to have a mass consistent with its being an antiproton. (auth)

11367

USE OF A RING SOURCE IN A HOMOGENEOUS FIELD RING FOCUSING BETA-RAY SPECTROMETER. II. J. A. Jungerman and D. B. Beard (Univ. of California, Davis). Rev. Sci. Instr. 27, 650(1956) Aug.

Previous estimates of the theoretical performance of a ring source in homogeneous magnetic field β-ray spectrometers are revised. The previous estimates are correct for $d \leq 1$, but for thin ring electrons, previously overlooked, revisions of the equations are offered. (T. R. H.)

11368

A NEW METHOD OF MEASURING ASYMMETRIES IN NEUTRON POLARIZATION EXPERIMENTS. P. Hillman, G. H. Stafford, and C. Whitehead (Atomic Energy Research Establishment, Harwell, Berks, England). Nuovo cimento (10) 4, 67-74(1956) July.

A solenoid has been constructed 11 feet in length and with a maximum rating of 1.14×10^6 ampere turns which enables the plane of polarization of a neutron beam to be turned through 90° in either direction. This enables asymmetry measurements to be made in neutron polarization experiments without moving the detecting apparatus. This is a great advantage in experiments in which polarization effects are small and false asymmetries, which can be introduced when the detector is moved, correspondingly very difficult to eliminate with sufficient accuracy. The method has been tested by using the partially polarized neutron beam produced with a beryllium target in the Harwell cyclotron. Asymmetry measurements were made by counting neutrons scattered at an angle of ½° off a uranium scatterer. Four values of the solenoid current were used and the results obtained agree well with those expected theoretically. (auth)

11369

ON n-PENTANE BUBBLE CHAMBERS. P. Bassi, A. Loria, J. A. Meyer, P. Mittner, and I. Scotoni (Istituto di Fisica dell'Universita, Padova). Nuovo cimento (10) 4, 491-500 (1956) Aug.

Both a clean and a dirty n-pentane bubble chamber have been operated. A description is given together with the results of an investigation into the influence which working conditions have on the sensitive time, and the size and number of the bubbles produced along the tracks. The number of bubbles per cm and their size are practically constant over a wide range of the final pressure; the foam limit does not depend on the final pressure. The sensitive time can be appreciably increased by an increase of the final pressure and there is a temperature range of a few degrees where the number of bubbles per cm is practically constant. (auth)

11370

NOMOGRAM FOR RADIOACTIVITY INDUCED IN IRRADIATION. Edward C. Freiling (U. S. Naval Radiological Defense

Lab., San Francisco). Nucleonics 14, No. 8, 65(1956) Aug.

This nomogram can be used for determination of the amount of material transmuted, amount of resulting activity, and the decay constant or half life of the induced activity. (W. L. H.)

11371

SIMPLE, INEXPENSIVE DEVICE CHECKS G-M TUBE OPERATION. F. E. Armstrong (Bureau of Mines, Bartleville, Okla.). Nucleonics 14, No. 8, 79-80(1956) Aug.

A new device has been developed for the determination of threshold voltage, slope, and length of the plateau for Geiger-Mueller tubes. The device was designed for use with a standard commercial counting-rate meter (Berkeley Model 2810) and a 1-milliampere, moving-coil-type strip chart recorder. (W. L. H.)

11372

SCINTILLATING GELS. B. Lionel Funt (Univ. of Manitoba, Winnipeg, Canada). Nucleonics 14, No. 8, 83-4(1956) Aug.

The preparation of a new type scintillator is presented. The scintillator is in the form of a gel. The liquid-scintillator solution contains p-diphenylbenzene and 1,4-bis-2-(5-phenyloxagolyl)-benzene (POPOP) in xylene, or a solution of phenylbiphenylyl oxadiazyole (PBD) in xylene or toulene and 5% by weight of Al sterate was added. (W. L. H.)

11373

DIODE-PHOTOTUBE MONITOR USES LIQUID SCINTILLATOR. W. R. Lamb (U. S. Naval Radiological Defense Lab., San Francisco). Nucleonics 14, No. 8, 84-5(1956) Aug.

A portable diode-phototube monitor using a liquid scintillator has been developed. The phototube is a vacuum diode. The cathode lead is soldered to an opaque Kovar insulator in the cap and the anode is grounded to the case. The phototube is bonded to the case with an adhesive which provides a hermetic seal of about 1,500-psi shear strength. The liquid scintillator used is 2-phenyl 5-(4-biphenylyl)-1,3,4-oxadiazole (PBD) and 1,4-di(5-phenyl-2-orazolyl)-benzene. (W. L. H.)

11374

CONTINUOUS ALPHA AIR MONITOR. David R. Sawle (Univ. of California Radiation Lab., Livermore). Nucleonics 14, No. 8, 90-5(1956) Aug.

A design for a continuous alpha air monitor is presented. The best operation was obtained for alpha emitters of ~5.5 Mev. It is completely insensitive to beta and gamma radiation and slightly sensitive to high neutron fluxes. (W. L. H.)

11375

CALIBRATED BENCH USED FOR GAMMA STANDARDIZING. D. E. Hull and G. H. Keirns (California Research Corp., Richmond). Nucleonics 14, No. 8, 95-6(1956) Aug.

A Geiger-Mueller tube is mounted in a fixed position at the end of a long bench. Standard positions are marked on the bench at known distances. The use of square roots of integers to measure distances from the counter tube makes it easy to calculate activities. (W. L. H.)

11376

THE PREPARATION AND MAINTENANCE OF STANDARDS OF RADIOACTIVITY. W. B. Mann (National Bureau of Standards, Washington, D. C.). Intern. J. Appl. Radiation and Isotopes 1, 3-23(1956) July.

A historical survey is made of the preparation and measurement of international radium standards. The need for standards of other radioisotopes is explained. Standardization is subdivided into primary and secondary methods; $4\pi\beta$ counting, β-γ and γ-γ coincidence counting, gas counting, and microcalorimetry are discussed as primary methods, and the maintenance of standards thus obtained is considered. The present state of international comparison of several radioisotopes is reported and discussed together with a policy for wider international standardization. (auth)

11377

LIQUID SCINTILLATORS: ATTRIBUTES AND APPLICATIONS. F. Newton Hayes (Los Alamos Scientific Lab., N. Mex.). Intern. J. Appl. Radiation and Isotopes 1, 46-56 (1956) July.

11378

ON A METHOD OF DISCRIMINATING CHARGED PARTICLES IN NUCLEAR EMULSIONS BY PHYSICAL DEVELOPMENT. Pierre Cuer, Christiane Gegauff, and Jean-Pierre Lonchamp. Compt. rend. 243, 709-12(1956) Aug. 20. (In French)

An attempt was made to discriminate between charged particles in nuclear emulsions by physical development. Using a very short chemical development preceding the physical development and fixing, it was found possible to distinguish α's from tritons in 50 to 100 μ Ilford C2 emulsions charged with Li and exposed to a slow neutron flux from a Ra–Be source. (tr-auth)

11379

MASS MEASUREMENTS IN NUCLEAR EMULSIONS BY MULTIPLE SCATTERING AND GAP DISTRIBUTION. Inder Sain Mittra (Muslim Univ., Aligarh, India). Indian J. Phys. 30, 363-70(1956) July.

A method of identifying singly charged particles in nuclear emulsions with the help of gap distribution and multiple coulomb scattering measurements for the same track is described. A parameter S depending upon scattering parameter $\bar{\alpha}_{100\mu}$ and gap distribution parameter g* is obtained, which is a logarithmic function of the mass. The observed values of S are in good agreement with the calculated ones. (auth)

11380

DETERMINATION OF RADIOIODINE UPTAKE IN THYROIDS BY TWO METHODS. Egilda DeAmicis and Earle W. Williamson (New England Deaconess Hospital, Boston). J. Am. Med. Assoc. 161, 1377-9(1956) Aug. 4.

11381

MEASUREMENT OF FAST-NEUTRON SPECTRA BY TIME OF FLIGHT. G. F. Bogdanov, A. A. Kurashov, B. V. Rybakov, and V. A. Sidorov. Soviet J. Atomic Energy, No. 1, 67-75(1956).

The principles and general design of a time-of-flight neutron spectrometer are reviewed. A coincidence circuit is used to measure the short time intervals, and a scintillation counter is used as the neutron detector. The resolving time of the spectrometer is 7 mμ sec. The efficiency and spectral sensitivity of the spectrometer are also briefly discussed. (B. J. H.)

11382

THE DEVELOPMENT OF RADIOMETRIC PROSPECTING INSTRUMENTS. H. Bisby (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Power 1, 122-4(1956) July.

The most commonly employed technique at present used for finding uraniferous ores is by means of gamma- and beta-ray surveys. These are commonly done from low-flying aircraft, cars or on foot and for preliminary prospecting lightweight portable instruments are required. The development of these has been aided by the introduction of the cold-cathode valve, the halogen-quenched geiger-müller counter and the transistor, and these in miniature form have led to several new British types of lightweight survey meter weighing only a few pounds. Further progress may be expected through the use of sub-miniature components. The introduction of scintillation counters with improved discrimination between terrestrial gamma rays and cosmic radiation has led to improved airborne equipment and a typical instrument is described. (auth)

11383

LOW PRESSURE DIFFUSION CHAMBER. A. P. Komar,

M. V. Stabnikov, and D. A. Yashin (Leningrad Physico-Technical Inst.). Doklady Akad. Nauk S.S.S.R. 108, 64-5 (1956) May 1. (In Russian)

Descriptions are given of a diffusion chamber, 30 cm in diameter, in which by selection of vapor and air pressures, and by regulation of vapor supply to the sensitive areas in the chamber, it was possible to identify particles of various ionization capacities. Under 30 mm Hg pressure of methyl alcohol and air, 46° temperature difference was found between the bottom (−4°) and top (−50°) of the chamber. By observing the areas around the tracks (which are shown as black bands near the light tracks) it is possible to identify particles by ionization. Results showed the effectiveness of the apparatus in identification of small-energy charged particles resulting from photonuclear reactions and for determination of their impulses when the apparatus is placed in a magnetic field. At low pressures the tracks spread very quickly which enables one to increase the number of pictures (pictures can be taken in less than 1-sec. intervals). Working depth for optimum cases with 30 mm Hg pressure is 20 mm with atm. pressure up to 10 mm. (R.V.J.)

11384

AN OPTIMUM PARAMETER BETA-RAY SPECTROMETER. C. Geoffrion and G. Giroux (Universite Laval, Quebec, Canada). Can. J. Phys. 34, 920-8(1956) Sept.

A semi-circular β spectrometer was constructed giving to the various parameters of the apparatus values such that the maximum intensity of a beam of monoenergetic electrons would be the largest possible at a given resolution. The apparatus sweeps a spectrum automatically, measures the rays with a limiting resolution approaching 0.07%, and can detect electrons of energies between 0 and 4 Mev. (tr-auth)

11385

DARK-AND PHOTOCONDUCTIVITY OF ANTHRACENES. Hans Joachim Zinszer. Z. Naturforsch. 11a, 306-11(1956) Apr. (In German)

Refer also to abstract 11570.

MESONS

11386

TOTAL CROSS SECTIONS OF POSITIVE π-MESONS ON HYDROGEN. A. E. Ignatenko, A. I. Mukhin, E. B. Ozerov, and B. M. Pontecorvo (Academy of Sciences, U.S.S.R.). Soviet Phys. JETP 3, 10-13(1956) Aug. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 7-11(1956) Jan. (In Russian)

Total cross sections of positive π-mesons on hydrogen were determined by the attenuation method, the beam of mesons passing through a scatter of liquid hydrogen. From the set of measured total cross sections of π^+ mesons on hydrogen and deuterium the contributions to the scattering of the different isotopic spin states at energies between 140 and 400 Mev are derived. (auth)

11387

MULTIPLE MESON PRODUCTION IN PARTICLE COLLISIONS. L. G. Iakovlev (Moscow State Univ.). Soviet Phys. JETP 3, 128-30(1956) Aug. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 203-5(1956) Jan. (In Russian)

The multiple production of mesons in particle collisions is considered in light of the field theory of the interaction of mesons with nucleons. (B.J.H.)

11388

K-MESON CHARGE EXCHANGE IN HYDROGEN AND DEUTERIUM. L. B. Okun. Soviet Phys. JETP 3, 142-3 (1956) Aug. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 218-19(1956) Jan. (In Russian)

The cross sections for K-meson charge exchange in H and D are discussed. (B.J.H.)

11389

SUPPRESSION OF PAIR EFFECTS IN DOUBLE π-MESON PHOTOPRODUCTION AT LOW ENERGIES. A. Petermann (Univ. of Copenhagen, Denmark). Phys. Rev. 103, 1053-5 (1956) Aug. 15.

The matrix element for the photoproduction of a (π^+,π^-) pair by γ rays on protons is examined in the low-energy region. Using the Deser-Thirring-Goldberger definition of the nucleon-meson interaction in a symmetric pseudoscalar theory with pseudoscalar coupling, it is shown that the leading term in an expansion in k/M (k being the kinetic energy of the light particles and M the mass of the nucleon), is exactly the pair-term contribution in the perturbation result ($\sim eg^2$), but occurring with the much smaller g_1^2 coupling constant. With the actual value of the pion mass, terms proportional, for instance, to $(\mu/M)g_p^2$ then become predominant. (auth)

11390

MESON PRODUCTION BY MESONS. Saul Barshay (Univ. of California, Berkeley). Phys. Rev. 103, 1102-7(1956) Aug. 15.

A calculation of meson production in a meson-nucleon collision has been carried out for the processes $\pi^+ + p \rightarrow \pi^+ + \pi^+ + n$ and $\pi^+ + p \rightarrow \pi^+ + \pi^0 + p$, by means of the method of Low. Use has been made of an approximate form of the Chew-Low transition matrix for scattering off the energy shell. This matrix exhibits explicitly the resonance behavior of the isotopic spin $3/2$, angular momentum $3/2$ scattering state. At 350-Mev incident-meson kinetic energy, the cross section for π^+ production is 0.86 mb and that for π^0 production is 5.5 mb. The angular distribution of each final state meson is of the form $A + \cos^2\theta$. For π^+ production, at 250-Mev incident-meson kinetic, A = 0.64. The final-state pions seem to share the available kinetic energy. The probability for a spin flip of the nucleon in the process is about 1.5 times the probability for no spin flip. (auth)

11391

PHOTOPRODUCTION OF Pi-MESON PAIRS. R. E. Cutkosky (Inst. for Theoretical Physics, Copenhagen, Denmark) and F. Zachariasen (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 103, 1108-10(1956) Aug. 15.

The cross section for photoproduction of pion pairs from hydrogen has been calculated from the cut-off static theory, assuming the energy is sufficiently low that one of the mesons is produced in an S state, the other in a P state. It is shown that the cross section for this process can be expressed exactly in terms of the P-wave scattering phase shifts, provided the S-wave meson-nucleon interactions and the meson-meson interaction can be neglected. The theoretical predictions obtained here are in general agreement with preliminary experimental results. (auth)

11392

CHARGE CONJUGATION AND THE τ^0 MESON. George A. Snow (Naval Research Lab., Washington, D. C.). Phys. Rev. 103, 1111-15(1956) Aug. 15.

The assumption of charge conjugation invariance, as used by Gell-Mann and Pais to discuss the decay of the θ^0 meson into two π mesons, has been applied to the decay of the τ^0 meson into three π mesons. Analogous to the θ^0-meson case, the τ^0 meson must be considered a "particle mixture" exhibiting two distinct lifetimes. There is no absolute selection rule against three-π-meson decay for either of these two τ^0 mesons, but their transition probabilities into three π mesons are quite different. For example, if the τ meson is a pseudoscalar particle, the ratio of these two transition probabilities is $\gg 100$. A brief dis-

cussion is given of other modes of decay of neutral heavy mesons and of some experimental consequences of this picture. (auth)

11393

TWO EXAMPLES OF MESONIC DECAY OF HYPERFRAGMENTS. P. H. Fowler and K. H. Jansen (Univ. of Copenhagen, Denmark). Nuovo cimento (10) 4, 158-63(1956) July.

Observations of the decay of He^{4*} in flight and of the decay of He^{5*} at rest are described in detail. (B.J.H.)

11394

ANGULAR CORRELATION METHODS FOR DETERMINING THE SPINS OF THE HYPERONS. R. Gatto (Instituto di Fisica e Scuola di Perfezionamento dell'Universita, Rome). Nuovo cimento (10) 4, 197-209(1956) Aug.

The intrinsic specification of the configuration of a cascade of two body decays—such as $\Xi^- \rightarrow \Lambda^0 + \pi^-$, $\Lambda^0 \rightarrow p + \pi^-$, or $\Sigma^0 \rightarrow \Lambda^0 + \gamma$, $\Lambda^0 \rightarrow p + \pi^-$—requires a parameter, the distribution of which will reflect the dynamical features of the process. A detailed discussion is given of these distributions and it is shown that when a sufficient number of Ξ^- cascade decays, and, similarly, of Σ^0 cascade decays, will have been collected, the comparison with the theory will furnish information on the spins and parities of the hyperons involved. (auth)

11395

MULTIPLE π^0-PRODUCTION IN ANTI-PROTON ANNIHILATION. A. N. Mitra (Muslim Univ., Aligarh, India). Nuclear Phys. 1, 571-80(1956) July.

The Feynman-Dyson formalism is applied to the calculation of multiple π^0 production in proton-antiproton annihilation. The calculations are along lines very similar to those recently followed by Gupta. It is found that contrary to the corresponding results of quantum electrodynamics, the cross section for the multiple production of π^0's begins to decrease only for values of $n > 15$. Since each π^0 decays into two photons almost immediately, the bearing of this result on the Schein event is briefly discussed. (auth)

Refer also to abstracts 11525 and 11553.

METEOROLOGY

11396

WORLD-WIDE TRAVEL OF ATOMIC DEBRIS. L. Machta, R. J. List, and L. F. Hubert (U. S. Weather Bureau, Washington, D. C.). Science 124, 474-7(1956) Sept. 14.

The dispersal of radioactive airborne particles from two nuclear tests in the Pacific Proving Grounds of the AEC was traced by counting the activity on sheets of gummed film exposed at stations located throughout the world. A series of maps illustrate the fall-out dispersal pattern at various times following the test shots. The effects of prevailing meteorological conditions on fall-out dispersal and deposition are discussed. It is pointed out that, while the sampling measures reported are crude, the radioactive debris produced by nuclear explosions provide a valuable meteorological tracer for studying global atmospheric circulations. (C.H.)

MOLECULAR PROPERTIES

11397

NUCLEAR MAGNETIC INTERACTIONS IN THE HF MOLECULE. I. Solomon and N. Bloembergen (Harvard Univ., Cambridge, Mass.). J. Chem. Phys. 25, 261-6(1956) Aug.

Magnetic relaxation times of H and F in anhydrous HF cannot be accounted for on the assumption of a pure dipole-dipole interaction between the H and the F nuclei in the same molecule. However, the introduction, in the Hamiltonian, of a scalar term $AI \cdot S$ resulting from the indirect electron-coupled interaction between the two nuclei removes all the discrepancies between the calculated and observed decay times. Although the splitting due to this scalar term is smeared out by the rapid chemical exchange of the protons with the traces of H_2O present in the acid, the nuclear Overhauser effect provides the extra parameter required to separate the dipole-dipole interaction from the scalar interaction and to calculate separately the scalar splitting and the exchange rate of the protons. The value obtained for the splitting is $A/h = 615$ cps. The same method has been applied to investigate the structure of the HF molecule in solutions. The experimental results can be explained qualitatively by the following picture: (a) The F nuclei form long chains that move more slowly than the Larmor frequency of F. (b) The chemical exchange with the relatively large quantity of H_2O present makes the motion of the H nuclei fast with respect to the H Larmor frequency. The results are: Long relaxation times for H with T_1 and T_2 equal, relatively short relaxation times for F resonance, with T_2 shorter than T_1. Solutions of salts of hydrofluoric acid (KF) show the same character as solutions of the acid. (auth)

11398

PROTON JUMPS AND THE ELECTRICAL BEHAVIOR OF ICE AND ICE–NH_4F SOLUTIONS. Soi Zaromb (Massachusetts Inst. of Tech., Cambridge). J. Chem. Phys. 25, 350-6(1956) Aug.

Previous suggestions that dielectric relaxation in ice may occur by means of proton shifts have been refuted by Bjerrum. Yet, the role of ions in this relaxation process cannot be ignored in view of the more recent studies on ice–NH_4F solutions, which indicate that solute ions can accelerate the rotation of ice molecules at a distance of 30 A or more from any ion. Simple electrostatic calculations show that proton jumps in ice would entail the formation of "Bjerrum fault sites." In the case of pure ice, this might explain why: (a) the proton jump conductivity is much lower than in water at 0°C; and (b) the concentration of fault sites seems to be rather high, according to Bjerrum. Estimates of the frequencies of proton jumps and of activation energies show no disagreement of the proposed explanations with known facts. In the case of ice–NH_4F solutions, proton jumps occurring between second-neighbor ion pairs, $F^- - H_2O - NH_4^+$, may also, induce fault sites at the neighboring molecules. This ion-pair mechanism would agree with the peculiar concentration dependence of the frequency factor. Finally, the thickness of the ion atmosphere should, at equilibrium, be less in ice–NH_4F solutions than in aqueous solutions of the same concentration. This, together with the above, might account for the changes with time in the dielectric relaxation rates of concentrated ice–NH_4F solutions observed immediately after freezing. (auth)

11399

CONCEPT OF INTERMOLECULAR FORCES IN COLLISIONS. James F. Hornig and Joseph O. Hirschfelder (Univ. of Wisconsin, Madison). Phys. Rev. 103, 908-17 (1956) Aug. 15.

For polar or electronically excited molecules the concept of intermolecular forces requires clarification. To calculate the equation of state or equilibrium properties, it suffices to use intermolecular forces which are averaged over the magnetic quantum numbers, but for nonequilibrium or transport properties it is necessary to know the intermolecular energy for each separate quantum state. There are many different representations of intermolecular forces, depending on which degrees of freedom are treated quantum mechanically and which classically. The whole concept of intermolecular force becomes nebulous when a large fraction of the collisions are not adiabatic. A semiclassical treatment is developed for describing the

trajectories of nonadiabatic collisions in which transitions occur infrequently. For grazing collisions, the colliding molecules are loosely coupled and best represented in terms of space fixed coordinates, but when the molecules approach each other more closely the internal degrees of freedom become tightly coupled, and then the intermolecular forces are best calculated in terms of a body fixed representation. The collisions with tight coupling are especially important for determining the kinetic theory properties of gases. (auth)

Refer also to abstract 11100.

NEUTRONS

11400 AERE-T/M-16

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

LEAKAGE OF NEUTRONS FROM A BAR (EXPERIMENTAL DETERMINATION OF SLOWING-DOWN LENGTHS). O. Buneman. Dec. 15, 1948. 6p.

11401

NUMERICAL CALCULATION OF THE DISTURBANCE OF AN INFINITE SPREAD DISK-SHAPED NEUTRON PROBE BY THE TRANSPORT THEORY. H. Meister. Z. Naturforsch. 11a, 579-85(1956) July. (In German)

11402

REACTOR PHYSICS. 4. James F. Hill (Reactor School, Harwell, Berks, England). Nuclear Power 1, 176-8(1956) Aug.

The mechanics of elastic scattering assume that the neutron and the nucleus can be treated as elastic spheres and that the ordinary laws of mechanics hold. A transformation is made from the laboratory system of coordinates to one based on the center of gravity of the particles and on the assumption that scattering is isotropic. In the latter system some important results are obtained. The average energy loss per collision is discussed and an expression derived for the number of collisions to slow down. When more than one type of atom is present in a medium, the average logarithmic energy loss and the average cosine of angle of scatter in the laboratory system of the elements have to be combined. (auth)

11403

TEMPERATURE DEPENDENCE OF THE THERMAL DIFFUSION LENGTH IN WATER. Robert W. Deutsch (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 1, 252(1956) July.

11404

THE DIFFUSION PARAMETERS OF THERMAL NEUTRONS IN WATER. A. Bracci and C. Coceva (Laboratori CISE, Milan). Nuovo cimento (10) 4, 59-66(1956) July.

A measurement of the diffusion time of slow neutrons in water is presented. The neutrons are produced with a pulsed source using d + d reaction and slowed down and diffused in cylindrical tanks of different shape filled with distilled water. Neutron detectors situated on the surface of the tanks and connected with an eighty channel time analyzer give a measure of the neutron flux as a function of time. Results obtained for the life time of neutrons in water and for the collision mean free path are discussed and compared with the known values. (auth)

Refer also to abstracts 11381, 11530, and 11531.

NUCLEAR PHYSICS

11405 AERE-R/M-8

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CRITICAL SIZE OF SOLUTIONS OF FISSILE MATERIALS IN WATER. J. D. McCullen. [nd]. 7p. (PSC-98).

The critical size of solutions of pure fissile materials and of enriched U in water are given for various concentrations. A table showing the critical sizes of 2:1 and 5:1 enriched U systems in water is given for concentrations of 0.2 and 0.3 grams of U per ml of water. (auth)

11406 CRP-642-A

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PROCEEDINGS OF THE SYMPOSIUM ON THE PHYSICS OF FISSION, HELD AT CHALK RIVER, ONTARIO, MAY 14-18, 1956. G. C. Hanna, J. C. D. Milton, W. T. Sharp, N. M. Stevens, and E. A. Taylor, eds. July 1956. 420p. (AECL-329). $5.00(AECL)

Eighteen papers are included, together with a condensation of the discussion on the papers. Some background fission physics, fission probability and results, and theoretical viewpoints are presented. (D.E.B.)

11407 HEPL-78

Stanford Univ., Calif. High-Energy Physics Lab.

THE STRUCTURE OF THE PROTON. E. E. Chambers and R. Hofstadter. Apr. 1956. 48p. Project R-357-20-9. Sponsored by ONR; AEC; and AF under Contract AF18(600)-646. (OSR-TN-56-151). $7.80(ph OTS); $3.30(mf OTS).

The structure and size of the proton have been studied by means of the methods of high-energy electron scattering. The elastic scattering of electrons from protons in polyethylene was investigated at the following energies in the laboratory system: 200, 300, 400, 500, and 550 Mev. The range of laboratory angles examined was 30 to 135°. At the largest angles and the highest energy, the cross section for scattering shows a deviation below that expected from a point proton by a factor of about nine. The magnitude and variation with angle of the deviations determine a structure factor for the proton, and thereby determine the size and shape of the charge and magnetic-moment distributions within the proton. An interpretation, consistent at all energies and angles and agreeing with earlier results from this laboratory, fixes the rms radius at $0.77 \pm 0.10 \times 10^{-13}$cm for each of the charge and moment distributions. The shape of the density function is not far from a Gaussian with rms radius 0.70×10^{-13}cm or an exponential with rms radius 0.80×10^{-13}cm. An equivalent interpretation of the experiments would ascribe the apparent size to a breakdown of the Coulomb law and the conventional theory of electromagnetism. (auth)

11408 KAPL-931(Del.)

Knolls Atomic Power Lab., Schenectady, N. Y.

REPORT OF THE PHYSICS SECTION FOR MARCH, APRIL, MAY 1953. Decl. with deletions Jan. 6, 1956. 83p. Contract W-31-109-Eng-52. $13.80(ph OTS); $4.80(mf OTS).

A three-group method of treating thermal reactors with high fuel density was developed and coded for IBM machines. The Weiner-Hopf solution for the albedo of a semi-infinite slab with isotropic scattering was evaluated. Curves are given for the interpretation of self-indication cross section measurements, and a method was developed for computing the effect of Doppler broadening. The integral representing the response of a detector to a disc source is evaluated. The effects of interstitial or foreign atoms on the diffraction pattern were determined. The average effect per defect is the same as that for a defect located at the center of a sphere. Tests on a double magnetic focusing mass spectrometer indicate an abundance sensitivity increase by the addition of the second magnet. An experiment designed to measure α vs. neutron energy in the range from subthermal to 1.0 ev for U^{233}

U^{235}, and Pu^{239} is described. Neutron resonance measurements on Ag and Mn are reported. The results of radiation effects studies on a large number of electrical and thermal insulation materials and organic compounds are given. A comparison of dose measurements made with polyvinyl film and ionization chamber dosimeters revealed an unexplained discrepancy. Studies of techniques for coating U by metal evaporation were continued. Tests to determine ev per charge for α particles impinging on a Ge junction yield values from 0.7 to 4.8. The reasons for this wide range are discussed. The effects of atmosphere on boundary friction in Pb–Fe and Ni–Cu couples were found to be significant. The friction characteristics of alloying and nonalloying bearings in spindle oil and NaK were compared. A new experiment was designed for determining pile radiation effects on graphite. Formulas for treating the data so obtained are given. (D.E.B.)

11409

THE ABSOLUTE LUMINESCENCE YIELD FOR γ-SCINTILLATIONS IN A NAPHTHALENE CRYSTAL WITH ANTHRACENE. M. D. Galanin and A. P. Grishin (P. N. Lebedev Physical Inst., U.S.S.R.). Soviet Phys. JETP 3, 32-9(1956) Aug. (In English). Zhur. Eksptl'. i Teoret. Fiz. 30, 33-41(1956) Jan. (In Russian)

By means of apparatus calibrated in absolute units, the absolute energy yield of luminescence for γ scintillations induced in a naphthalene-anthracene crystal by Compton electrons was found to be $0.7 \pm 0.2\%$. (auth)

11410

DIFFRACTION SPLITTING OF FAST NONRELATIVISTIC DEUTERONS. A. I. Aliev and E. L. Feinberg (P. N. Lebedev Physical Inst., U.S.S.R.). Soviet Phys. JETP 3, 85-93(1956) Aug. (In English). Zhur. Eksptl'. i Teoret. Fiz. 30, 115-25(1956) Jan. (In Russian)

A calculation of diffraction splitting is carried out for deuterons of energies of order 100 Mev interacting with nuclei whose dimensions are large compared with those of the deuteron. It is shown that the total cross section for the process has the behavior of the stripping cross section. The angular distributions of the outgoing proton and neutron in correlated pairs and their energy distribution have the same behavior as in deuteron stripping when either a neutron or a proton is scattered out. Because of the indeterminacy of the structure of the nuclear surface (and its transparency for fast nucleons) and the lack of knowledge about the behavior of the deuteron wave function for small neutron-proton separations, the formulae obtained are good only for some of the processes; namely, the processes in which a small amount of momentum is transferred to the nucleus. The total cross section is only estimated. The angles and the energy spectrum for diffraction splitting are different from those of the electric (Coulomb) splitting. The cross section of the diffraction splitting is independent of energy and increases with the atomic number as $A^{\frac{1}{3}}$. (auth)

11411

EXCITATION OF THE COLLECTIVE LEVELS OF HEAVY NUCLEI BY NEUTRONS. D. F. Zaretskii and A. V. Shut'ko. Soviet Phys. JETP 3, 98-104(1956) Aug. (In English). Zhur. Eksptl'. i Teoret. Fiz. 30, 141-7(1956) Jan. (In Russian)

On the basis of the modal representation of A. Bohr and B. Mottelson, the inelastic scattering of neutrons by the collective levels of the target nucleus are calculated for the case in which there is no compound nucleus formation. (auth)

11412

ON THE FIRST APPEARANCE OF ATOMIC ELECTRONS WITH l, n, n_r AND n + l GIVEN. V. M. Klechkovskii. Soviet Phys. JETP 3, 125-7(1956) Aug. (In English). Zhur. Eksptl'. i Teoret. Fiz. 30, 199-201(1956) Jan. (In Russian)

Expressions for Z_l, the atomic number of an element, are briefly discussed. (B.J.H.)

11413

NUCLEON-HOLE INTERACTION IN jj COUPLING. Sudhir P. Pandya (Univ. of Rochester, N. Y.). Phys. Rev. 103, 956-7(1956) Aug. 15.

A theorem connecting the energy levels in jj coupling of a nucleon-nucleon and nucleon-hole system is derived, and applied in particular to Cl^{38} and K^{40}. (auth)

11414

GROUND-STATE PROPERTIES OF NONSPHERICAL NUCLEI. Kurt Gottfried (Massachusetts Inst. of Tech. and Harvard Univ., Cambridge). Phys. Rev. 103, 1017-31 (1956) Aug. 15.

A knowledge of the wave functions and energy levels for nucleonic motion in a nonspherical force field is a prerequisite to any detailed comparison between the empirical data and the model of Bohr and Mottleson. An extremely simple model for this internal problem is provided by the motion of independent particles in an ellipsoidal oscillator potential. By minimizing the total energy of such a system, it is concluded (1) that deformations which possess an axis of symmetry are always preferred by low-lying states, and (2) that this model cannot reproduce the observed preponderance of positive quadrupole moments. This last conclusion is unaltered by the surface tension or Coulomb repulsion. The oscillator model is too simplified for the computation of spins or magnetic moments (μ). Determinations were made of wave functions and energy levels for independent-particle motion in a spheroidal square well, including spin-orbit coupling. Because of the approximations made in this calculation, the levels cannot be used to compute the equilibrium shape, but only to assign the ground-state level and wave function. Thus the present scheme is intended to replace that of the shell model in the region of large deformations. With the exception of W^{183}, spins were assigned to all the odd-A nuclei for which $150 \lesssim A \lesssim 190$. The ease and consistency with which such an assignment can be made leads to the conclusion that the scheme is essentially correct for those nuclei which possess large deformations, and whose odd particle lies in the 50 to 82 shell or the lower part of the 82 to 126 shell. In addition, μ was computed in this region. Here the agreement is more limited, but there are a number of important successes: we reproduce the large difference in μ for the europium isotopes, the ratio of the magnetic moments of the two hafnium isotopes, both μ and the decoupling coefficient for Tm^{169}, and μ for $Yb^{171,173}$, Re, Eu^{151}, and Os^{189}. The properties of the ground state and first excited state of Ag^{109} are also found to be in good agreement with the theory. (auth)

11415

ELECTRIC-MONOPOLE TRANSITIONS IN ATOMIC NUCLEI. E. L. Church (Frankford Arsenal, Philadelphia) and J. Weneser (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 1035-44(1956) Aug. 15. (cf. NSA 10-1530)

Low-energy electric-monopole or E0 transitions ($\Delta I = 0$, no) proceed solely by internal conversion, with zero units of angular momentum transferred to the ejected electron. Single gamma-ray emission of this multipole order is strictly forbidden. Electric-monopole pair production is possible for transition energies greater than $2mc^2$. It is pointed out that (1) the electric-monopole mode of deexcitation is available between any two equal-parity states of the same spin, zero or otherwise, (2) in such cases, E0 internal conversion may compete favorably with the paralleling magnetic-dipole and electric-quadrupole transitions in heavy nuclei, and (3) monopole matrix elements may be

particularly useful in the study of nuclear structure. The relative and absolute conversion properties of electric-monopole transitions have been calculated relativistically, including the effects of the finite nuclear size and bound-state atomic screening. These results have been used to analyze the available experimental data on the $2+ \rightarrow 2+$ transitions in Hg^{198}, Pt^{196}, and Pt^{192}, and to determine upper limits for the monopole matrix elements. These upper limits appear appreciably smaller than the values for the matrix elements of well-known monopole transitions of the $0+ \rightarrow 0+$ type. The possible significance of these results is considered with reference to current nuclear models. (auth)

11416

HIGH-ENERGY INTERFERENCE EFFECT OF BREMSSTRAHLUNG AND PAIR PRODUCTION IN CRYSTALS. H. Überall (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 103, 1055-67(1956) Aug. 15.

With the use of monocrystalline targets for bremsstrahlung and pair production experiments, interference phenomena are expected to occur which will markedly change the γ-ray spectrum as well as the pair energy distribution, for certain angles giving enhancement of radiation and pairs. The effect increases with energy; it sets in at $\delta \lesssim n_0(2\pi/a)$, where δ is the minimum momentum transfer to the target atoms, a the lattice constant, and n_0 a number of the order 2 or 3. This corresponds to ~200-Mev primary energy for bremsstrahlung, ~1 Bev for pair production. The effect is confined to angles between the primary beam and a line of atoms, of order $\theta \lesssim (a_{screen}/\lambda\!\!\!^{-}_C)\ (mc^2/E)$. The temperature motion of the lattice reduces the interference effect to some extent. The Born approximation was used for the quantitative analysis of the problem. (auth)

11417

RELATION BETWEEN NUCLEON DENSITY AND NUCLEAR POTENTIAL. K. A. Brueckner (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 1121-4 (1956) Aug. 15.

The relationship between nuclear density and potential is determined, taking account of the saturating character and the finite range of the two-body forces. The former characteristic alone leads to the nonlinear relation between nuclear density and potential pointed out by Wilets, and accounts for an increase of potential radius over density radius of about 5×10^{-14} cm. The finite-range effect is estimated by using pseudopotentials to represent the two-body interaction operators generated by the two-body potentials. The combined effects of nonlinearity and finite range give an increase in the rms potential radius which is very close to that observed experimentally. The fall-off distance of the potential surface predicted is, however, somewhat greater than that empirically determined. It is pointed out that this discrepancy may be removed if proper account is taken of the nonlocal character of the nuclear potential. (auth)

11418

PARAMAGNETIC RESONANCE REORIENTATION OF ATOMS AND IONS ALIGNED BY ELECTRON IMPACT. H. G. Dehmelt (Univ. of Washington, Seattle). Phys. Rev. 103, 1125-6(1956) Aug. 15.

A study was made of the alignment resulting when atoms are excited to non-S states by electron impact. An experiment performed on Hg atoms in the metastable $^3P_2$ state is described in order to illustrate double-hit ionization techniques for studying the alignment. (B.J.H.)

11419

Λ^0-NUCLEON FORCES. Don B. Lichtenberg and Marc Ross (Indiana Univ., Bloomington, Ind.). Phys. Rev. 103, 1131-2(1956) Aug. 15.

It is shown that a simple field-theoretic model can be used to predict strong and highly spin-dependent Λ-nucleon forces. Calculated Λ-nucleon potentials are given graphically. (B.J.H.)

11420

BETA DECAY OF A C^9 NUCLEUS. M. S. Swami, J. Schneps, and W. F. Fry (Univ. of Wisconsin, Madison). Phys. Rev. 103, 1134-5(1956) Aug. 15.

In a survey of photographic emulsions exposed to 3-Bev protons, a connected double star was found which is interpreted to be the disintegration of a C^9 nucleus. A detailed description of the event is included. (B.J.H.)

11421

ANTI-PROTON ANNIHILATION. H. A. Bethe and J. Hamilton (Cavendish Lab., Cambridge, England). Nuovo cimento (10) 4, 1-22(1956) July.

It is shown how simple experiments on the annihilation of the antiproton in various materials may be used to determine the nature of the annihilation process in nuclear matter, and to get information on nucleon-antinucleon forces. The annihilation of antiprotons from atomic states is examined in detail, and corrections are made for specifically nuclear effects. (auth)

11422

OBSERVATION OF ELECTRON SECONDARIES FROM V^0 DECAYS. M. M. Block, E. M. Harth, M. E. Blevins, and G. G. Slaughter (Duke Univ., Durham, N. C.). Nuovo cimento (10) 4, 46-50(1956) July.

Three examples of V^0 particles having electron secondaries have been observed in a cloud chamber exposed to a 1.9-Bev π^- beam from the Cosmotron. The experimental evidence is suggestive of the decay scheme, $K^0_{e3} \rightarrow \pi^+ + e^- + \nu$. (auth)

11423

AN ATTEMPT IN THE THEORY OF ELEMENTARY PARTICLES. T. Tati (Kanazawa Univ., Japan). Nuovo cimento (10) 4, 75-87(1956) July.

11424

ON THE PHOTODISINTEGRATION OF THE DEUTERON AND p-p SCATTERING. Shih-Hui Hsieh (Physical Inst., Nagoya Univ.). Nuovo cimento (10) 4, 138-40(1956) July.

Nuclear forces and a phase shift analysis of p-p scattering are briefly discussed. (B.J.H.)

11425

SOME CONSIDERATIONS ON THE CHARGE-EXCHANGE SCATTERING OF ANTINUCLEONS ON NUCLEONS. D. Amati and B. Vitale (Univ. of Rome). Nuovo cimento (10) 4, 145-6(1956) July.

11426

ON THE POLARIZATION OF BREMSSTRAHLUNG. R. Ascoli and G. Bussetti (Univ. of Torin). Nuovo cimento (10) 4, 147-9(1956) July. (In Italian)

11427

DETERMINATION OF THE p-WAVE COUPLING CONSTANT f^2 OF PION-NUCLEON SCATTERING FROM ANALYSIS OF THE α_{31} PHASE-SHIFT. A. Stanghellini (Istituto di Fisica dell 'Universita, Bologna). Nuovo cimento (10) 4, 168-71 (1956) July.

11428

ON THE STUDY OF THE BREMSSTRAHLUNG BY BLOCH AND NORDSIECK'S METHOD. R. Ascoli and G. Bussetti (Istituto di Fisica dell'Universita, Torin). Nuovo cimento (10) 4, 189-96(1956) Aug.

The single bremsstrahlung is studied with Bloch and Nordsieck's approximation. The resulting formula is compared with that obtained by the perturbation method. The agreement of the two formulae for low energy photons is verified. The polarization of the emitted radiation, using a approximate formula is also studied. In particular, it is

shown in a simple way that, for emission angles lying in a certain range of values, the emitted radiation is mostly polarized with its electric vector perpendicular to the emission plane, in agreement with Wick's results. Moreover it appears that, for a certain angle of emission, the low energy photons are entirely polarized with the electric vector perpendicular to the emission plane. (auth)

11429

THE APPLICATION OF CHARGE INDEPENDENCE TO THE NUCLEAR CAPTURE OF NEGATIVE K-MESONS. M. Koshiba (Univ. of Chicago). Nuovo cimento (10) 4, 357-68 (1956) Aug.

The results of the charge independence hypothesis are compared with the existing experimental data on the nuclear capture of negative K mesons. The comparison of the calculated Σ^-/Σ^+ and π^-/π^+ emission ratios with the experimental ones strongly suggest the dominance of the T = 1 state over the T = 0 state in the primary act. Furthermore, the π^-/π^+ emission ratio is shown to give an estimate of the branching ratio between Σ emission and Λ^0 emission, which is free from the ambiguities due to the secondary absorption of the products of the primary act or due to the difficulties of detecting neutral particles and is only slightly affected by secondary charge exchange scatterings of the product particles. The preliminary value thus determined by using the experimental data thus far available for the π^-/π^+ emission ratio, suggests that Σ emission is more favored than Λ^0 emission in the primary act. The implications of measuring the positive-to-negative ratio of high-energy π mesons emitted from K^- captures is discussed in some detail and a few experiments are proposed in this connection. (auth)

11430

ON THE CONSEQUENCES OF THE POSSIBLE EXISTENCE OF THE HYPERDEUTERON. M. Ferentz and S. Raboy (Argonne National Lab., Lemont, Ill.). Nuovo cimento (10) 4, 487-90(1956) Aug.

It is suggested that the observation of a hyperdeuteron is an indirect method for detection of the neutral cascade particle which is predicted by the scheme of Gell-Mann and that of Salam and Polkinghorne. The consequences for these schemes are examined, and some possible methods for preferential selection of one of the schemes are suggested. (auth)

11431

DETECTION OF THE FREE NEUTRINO: A CONFIRMATION. C. L. Cowan, Jr., F. Reines, F. B. Harrison, H. W. Kruse, and A. D. McGuire (Los Alamos Scientific Lab., N. Mex.). Science 124, 103-4(1956) July 20.

Experiments are described which verified a tentative identification of the free neutrino made at Hanford in 1953. The reaction $\nu_- + p^+ \rightarrow \beta^+ + n$ was employed. (D. E. B.)

NUCLEAR PROPERTIES

11432 AECU-3126

Michigan. Univ., Ann Arbor.

DETERMINATION OF (d,alpha) REACTION CROSS SECTIONS. Kenneth Lynn Hall. Sept. 21, 1955. 233p. Project No. 7. Contract AT(11-1)-70. $1.25(OTS).

Apparatus and procedures were developed for the accurate measurement of (d,α) reaction cross sections, using 7.8-Mev deuterons from the Univ. of Michigan cyclotron. Thin targets were prepared by metal evaporation, bombardment was accomplished in a specially designed chamber, the product nuclei were chemically separated, and the absolute disintegration rates of the β-emitting products were determined. Cross sections for the (d,α) reaction for Na^{22}, Na^{24}, P^{32}, Sc^{46}, Ag^{104}, Ag^{111}, and Ag^{112} are given. (D.E.B.)

11433 BNL-2714

Brookhaven National Lab., Upton, N. Y.

THE EFFECTIVE REMOVAL CROSS SECTION OF IRON. R. D. Schamberger and F. J. Shore. Nov. 22, 1955. 15p. $3.30(ph OTS); $2.40(mf OTS).

The effective fast neutron removal cross section for iron was obtained mathematically from thermal neutron measurements in the Brookhaven shielding facility. (F.S.)

11434 CRRP-659

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

CALCULATED CROSS SECTIONS OF IRRADIATED FISSION PRODUCTS. D. G. Hurst. July 1956. 11p. (AECL-346).

The cross section of irradiated fission products has been calculated as a function of irradiation for U^{233}, U^{235}, Pu^{239}, and Pu^{241}. In many cases the nuclides produced from fission products by neutron capture have been included. The results, up to an irradiation of 10 neutrons per kilobarn, can be expressed as if fission gave only three pseudo fission products of cross sections 40, 200, and 1000 barns with yields which depend on the fissile nuclide. For U^{233} and U^{235} the 40 and 200 barn pseudo fission products are sufficient. (auth)

11435

MEASUREMENT OF NUCLEAR MAGNETIC RELAXATION TIME IN FREE PRECESSION MOTION (OSCILLATION). Günther Laukien. Z. Naturforsch. 11a, 266-73(1956) Apr. (In German)

11436

COULOMB-IMPULSE OF ROTATION PHASE OF Gd^{155} AND Gd^{158} NUCLEI. J. H. Bjerregaard and U. Meyer-Berkhout. Z. Naturforsch. 11a, 273-7(1956) Apr. (In German)

11437

ISOTOPIC EFFECT IN ELECTROLYTIC MIGRATION OF Pb IONS IN MOLTEN $PbCl_2$. A. Lundén, G. Horlitz, and P. Signer. Z. Naturforsch. 11a, 280-3(1956) Apr. (In German)

11438

THE MASS OF LIGHT NUCLIDES. J. Mattauch, L. Waldmann, R. Bieri, and F. Everling. Z. Naturforsch. 11a, 525-48(1956) July. (In German)

11439

ISOTOPIC ENRICHMENT OF Li THROUGH ELECTROLYTIC CONVERSION IN MOLTEN LiB. Arnold Lunden. Z. Naturforsch. 11a, 590-2(1956) July. (In German)

11440

ON THE ELECTRON CAPTURE DECAY ENERGY OF $^{153}_{64}Gd$. R. K. Gupta and S. Jha (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 4, 88-95(1956) July.

The summing technique in a scintillation spectrometer has been used to determine the electron capture decay energy of Gd^{153}. The decay energy is 225^{+18}_{-13} kev. The internal conversion coefficients of the 102-kev γ ray have been measured in the scintillation spectrometer. The K conversion coefficient of this γ ray is 0.61 ± 0.03 and $K/(L+M) \sim 5$. It has been estimated that about 25% of the transitions go to the ground state of Eu^{153}. (auth)

11441

β-γ ANGULAR CORRELATION OF $^{208}_{81}Tl(ThC'')$. F. Demichelis and R. A. Ricci (Istituto di Fisica Sperimentale del Politecnico, Torin). Nuovo cimento (10) 4, 96-105(1956) July.

The angular correlation between the 2.37-Mev β radiation and the 2.62-Mev γ ray in $Tl^{208} \rightarrow Pb^{208}$ decay has been measured and found anisotropic. The value of the anisotropic coefficient is $-(0.585 \pm 0.06)$. Assuming the spin and parity assignment for the excited levels of Pb^{208} suggested by Elliot et al., J = 4+ is deduced for the Tl^{208} ground state.

On the basis of the various experimental results, the most reliable assignment of the spin and parity for the Bi^{212} ground state should be J = 1− or 2 − according to the assignment suggested by Martin and Parry and to the order of forbiddeness of the Bi^{212} β transitions. (auth)

11442

EFFECT OF CENTRE-OF-MASS MOTION ON NUCLEAR MOMENTS. J. P. Elliott and T. H. R. Skyreme (Atomic Energy Research Establishment, Harwell, Berks, England). Nuovo cimento (10) 4, 164-5(1956) July.

The evaluation of nuclear moments is briefly discussed. (B.J.H.)

11443

ORBITAL ELECTRON CAPTURE IN ^{179}Ta. A. Bisi, L. Zappa, and E. Zimmer (Istituto di Fisica Sperimentale del Politecnico, Milan). Nuovo cimento (10) 4, 307-12(1956) Aug.

The electron capture decay of Ta^{179} has been investigated. No γ rays were observed. The P_L/P_K capture ratio was measured and found to be $P_L/P_K = 1.4 \pm 0.4$. The corresponding transition energy is $E_0 = 94^{+9}_{-4}$ kev. By means of a coincidence method the L-fluorescence yield for transition to the L level following the K capture was measured and found to be $\omega_{LK} = 0.17 \pm 0.02$. (auth)

11444

NUCLEAR LEVELS IN S^{32}, S^{34}, Cl^{35}, AND Cl^{37}. P. M. Endt, C. H. Paris (Physisch Laboratorium der Rijksuniversiteit, Utrecht, Netherlands) and A. Sperduto and W. W. Buechner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 103, 961-4(1956) Aug. 15.

Barium-chloride targets have been bombarded with protons accelerated by an electrostatic generator to an energy of 7.04 Mev. Charged reaction products (alpha particles and elastically and inelastically scattered protons) were observed at 90 and 130 degrees to the proton beam with a high-resolution magnetic analyzer. The following ground-state Q values have been measured: $Cl^{35}(p,\alpha)S^{32}$, Q = 1.863 ± 0.008 Mev; $Cl^{37}(p,\alpha)S^{34}$, Q = 3.026 ± 0.008 Mev. Levels were observed in S^{32} at 2.237, 3.780, 4.287, 4.465, and 4.698 Mev; in S^{34} at 2.127, 3.302, 3.915, 4.073, 4.114, 4.621, 4.685, and 4.876 Mev; in Cl^{35} at 1.221, 1.763, 2.645, 2.695, 3.006, (3.165), 4.058, 4.113, and 4.174 Mev; in Cl^{37} at 0.838, 1.728, (3.087), and (3.105) Mev. (auth)

11445

HALF-LIVES AND ALPHA ENERGIES OF Cm^{248} AND Cm^{246}. J. P. Butler, T. A. Eastwood, and H. G. Jackson (Atomic Energy of Canada Ltd., Chalk River, Ont.) and K. P. Schuman (Knolls Atomic Power Lab., Schenectady, N. Y.). Phys. Rev. 103, 965-6(1956) Aug. 15.

The new isotope Cm^{248}, the daughter of Cf^{252}, has been separated from a sample of californium. Cm^{248} decays by the emission of a 5.054 ± 0.015 Mev α particle with an alpha half life $(4.7 \pm 0.4) \times 10^5$ years. The spontaneous fission half life of Cm^{248} was found to be $(4.6 \pm 0.5) \times 10^6$ years. Cm^{246} was also observed in the curium daughters isolated from the californium sample; the Cm^{246} decays by the emission of a 5.373 ± 0.010 Mev α particle with a half life of 6620 ± 320 years. (auth)

11446

NUCLEAR RESONANCE FLUORESCENCE IN Ni^{60}. Franz R. Metzger (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 103, 983-7(1956) Aug. 15.

The gamma radiation emitted by a gaseous source of $Co^{60}Cl_2$ has been used to excite the 1.33-Mev level in Ni^{60}. The angular distribution of the resonance radiation characterizes the spin of the 1.33-Mev excited state as 2 and the spin of the Ni^{60} ground state as 0. A resonance fluorescence self-absorption experiment has been performed and from it a mean life of $(1.1 \pm 0.2) \times 10^{-12}$ second has been calculated for the 1.33-Mev excited state of Ni^{60}. (auth)

11447

INELASTIC SCATTERING OF NEUTRONS. Ira L. Morgan (Univ. of Texas, Austin). Phys. Rev. 103, 1031-4 (1956) Aug. 15.

Inelastic scattering of fast neutrons in Al, Na, S, Fe, Cu, I, and Cd has been detected by observing the gamma radiation from the excited states. The cross sections for gamma-ray production at energies well above threshold in Fe and Al have been measured. The gamma-ray energies observed correspond to known levels, transitions between levels, or de-excitation from neutron capture. (auth)

11448

EFFECTS OF SUPEREXCHANGE ON THE NUCLEAR MAGNETIC RESONANCE OF MnF_2. R. G. Shulman and V. Jaccarino (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 103, 1126-7(1956) Aug. 15.

Observations were made on nuclear magnetic resonances in Fe^{19} in oriented single crystals of MnF_2. Data are included on the shift in the F^{19} resonance field as a function of the external magnetic field, and on the separation of the two resolved resonance lines as a function of the angle between the external field and the crystal's b axis. (B.J.H.)

11449

NUCLEAR MAGNETIC RESONANCE OF Si^{29} IN n- AND p-TYPE SILICON. R. G. Shulman and B. J. Wyluda (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 103, 1127-9(1956) Aug. 15.

The nuclear magnetic resonances of Si^{29} in high-purity Si were observed at room temperatures, and the spin-lattice relaxation time was determined as a function of sample resistivity. Pertinent data are given in graphical form. (B.J.H.)

11450

EVIDENCE FOR REDUCTION OF M1 K-SHELL INTERNAL CONVERSION COEFFICIENT. F. K. McGowan and P. H. Stelson (Oak Ridge National Lab., Tenn.). Phys. Rev. 103, 1133-4(1956) Aug. 15.

Data on K-shell internal conversion coefficients and values for E_2/M_1 derived from Coulomb excitation experiments are given to support evidence for the reduction of M1 K-shell internal conversion coefficients. The conversion coefficients of Ta^{181}, Au^{197}, and Tl^{203} are discussed. (B.J.H.)

11451

THE LIFETIME OF THE 200 KEV EXCITED STATE OF ^{19}F. C. M. P. Johnson (Cavendish Lab., Cambridge, England). Phil. Mag. (8) 1, 573-5(1956) June.

Two NaI crystals in a fast coincidence circuit were used to study the lifetime of the 200-kev excited state of F^{19}. The F^{19} sources used were discs of teflon irradiated by fast neutrons. The value of the mean life was found to be $(1.25 \pm 0.025) \times 10^{-7}$ sec. which is in good agreement with other determinations. (B.J.H.)

11452

THE MAGNETIC MOMENT OF THE 200 KEV EXCITED STATE OF ^{19}F. W. R. Phillips and G. A. Jones (Cavendish Lab., Cambridge, England). Phil. Mag. (8) 1, 576-83(1956) June.

The magnetic moment of the 200-kev excited state of F^{19} was measured by observing the influence of an external magnetic field on the directional properties of a $\gamma-\gamma$ cascade through this state. The cascade follows the β decay of O^{19} produced by neutron bombardment of HF. The result, $\mu = +3.50 \pm 0.24$ n.m., assumes that no time-dependent quadrupole interaction is present in the source; the effect of the possible presence of such an interaction is discussed. (auth)

11453

THE SPIN AND MAGNETIC MOMENT OF ^{116*}In. P. B. Nutter (A.S.R.E., Portsmouth, Hants, England). Phil. Mag. (8) 1, 587-8(1956) June.

A conventional atomic-beam apparatus using magnetic resonance was used to study the spin and magnetic moment of the 52-min In^{116} isomer. The In^{116} source was obtained by irradiating In metal in the Harwell pile. Magnetic moments are given for various configurations. (B.J.H.)

11454

THE SPIN OF THE 2.9 MEV STATE OF Be^8. A. J. F. Boyle (Australian National Univ., Canberra). Nuclear Phys. 1, 581-4(1956) July.

The spin of the 2.9-Mev state of Be^8 has been determined by an angular correlation measurement between the direction of emission of the 14.8-Mev γ rays and the corresponding α particles arising from the state formed in the reaction Li^7 (pγ) Be^{8*}(α) He^4. It is found to be 2, and the results also show that the γ transition from the 17.6-Mev 1^+ state to the 2^+ state is a mixture of M1 and E2 radiations. (auth)

11455

L/K CAPTURE RATIO IN ^{153}Gd AND LOW-LYING LEVELS IN ^{153}Eu. A. Bisi, E. Germagnoli, and L. Zappa (Istituto di Fisica Sperimentale del Politecnico, Milan, Italy). Nuclear Phys. 1, 593-602(1956) July.

The electron capture decay Gd^{153} has been investigated. Only one γ ray, of energy 104 kev, was found to follow the electron capture decay; its K conversion coefficient was found to be $\alpha_K = 0.70 \pm 0.03$. By using the integrating features of the scintillation spectrometer and by means of coincidence techniques , the L- to K-capture ratio for the transition to the excited state of Eu^{153} was obtained. It was found that $P_L/P_K = 0.68 \pm 0.02$ which corresponds to a transition energy $E_0 = 83 \pm 2$ kev. No branching to the ground state was found. A decay scheme is proposed. The disagreement between these results and those obtained by means of Coulomb excitation of Eu^{153} is pointed out and briefly discussed. (auth)

11456

NEUTRON YIELDS FROM ACTINIDE-BERYLLIUM ALLOYS. O. J. C. Runnalls and R. R. Boucher (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys. 34, 949-58(1956) Sept.

The neutron yields from the reaction $Be^9(\alpha,n)C^{12}$ have been measured for several actinide–beryllium alloys. The values for the Be thick target neutron yield, derived from the measurements on alloys containing Pu^{239}, Am^{241}, and Cm^{242}, are 60 ± 2, 74 ± 2, and 112 ± 3 neutrons per million alphas, respectively, when based on the Chalk River standard Ra^{226}-α-Be source. The dependence of the thick target yield, n_{max}, on the alpha-particle energy, E, is described by the empirical formula $n_{max} = 0.152\ E^{3.65}$ neutrons per million alphas. The yields for Ra-α-Be and Ac^{227}-α-Be, calculated from the latter expression, are in reasonable agreement with the best observed yields from powder-compacted sources. For Po-α-Be, the calculated thick target yield of 67 neutrons per million alphas lies within the limits of error of the yield observed by several earlier workers. (auth)

11457

MEASUREMENT OF THE NEUTRON YIELDS FROM ACTINIDE-BERYLLIUM ALLOYS. G. C. Hanna and O. J. C. Runnalls (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys. 34, 959-67(1956) Sept.

The neutron yields of a series of actinide–beryllium sources have been measured. Some of the sources were compared with primary neutron standards in a manganese sulfate bath. The experimental procedure is described in detail and corrections for the loss of neutrons from the bath are discussed. These measurements include a comparison of the Chalk River Ra-α-Be and the National Bureau of Standards Ra-γ-Be standard sources. The majority of the actinide–beryllium alloy sources were then compared with the standardized sources in simple boron trifluoride counter systems. (auth)

11458

ENERGY LEVELS OF Pu^{238} AND Pu^{239} NUCLEI. S. A. Baranov and K. N. Shlyagin. Soviet J. Atomic Energy, No. 1, 51-65(1956).

A double-focusing magnetic β spectrometer, a γ scintillation spectrometer, and a proportional counter were used to study the radiations from Np^{238}, Np^{239}, and Cm^{242}. Resultant spectra are shown, and the level schemes of the Pu^{238} and Pu^{239} nuclei are given. (B. J. H.)

11459

HALF-LIFE OF 2.7-DAY Au-198. C. Sastre and G. Price (Brookhaven National Lab., Upton, N. Y.). Nuclear Sci. and Eng. 1, 325-6(1956) Aug.

The half life of 2.7-day Au^{198} has been measured, using end window Geiger counters, over a period of 24 days, and found to be 2.694 ± 0.006 days. (auth)

11460

MEASUREMENTS OF THE ANISOTROPY OF GAMMA RADIATION EMITTED BY ORIENTATED ^{52}Mn NUCLEI. W. J. Huiskamp, M. J. Steenland, A. R. Miedema, H. A. Tolhoek, and C. J. Gorter (Kamerlingh Onnes Laboratorium, Leiden, Netherlands). Physica 22, 587-94(1956) July.

Measurements are reported of the anisotropy of the intensity of the gamma radiation emitted by Mn^{52} nuclei, orientated at low temperatures. The nuclei were orientated in Ce–Mg–nitrate single crystals both by the alignment method and by polarization in an external magnetic field. From the results, it is concluded that the spins of the 3 excited states of Cr^{52} are 2, 4, and 6, all radiations being E2. The alignment anisotropy as a function of temperature showed an unusual character, which has been compared with the results obtained by the Oxford groups on Mn^{54}. (auth)

11461

NEUTRON SPECTRA IN THE BOMBARDMENT OF TRITIUM AND DEUTERIUM BY 14 MEV DEUTERONS. G. F. Bogdanov, N. A. Vlasov, S. P. Kalinin, B. V. Rybakov, and V. A. Sidorov. Soviet Phys. JETP 3, 113-15(1956) Aug. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 185-7(1956) Jan. (In Russian)

An attempt was made to verify the existence of a 22-Mev excited level of He^4 by investigating the neutron spectrum from the reaction T(d,n)He^4. The experiments were made in a cyclotron, and the spectra were investigated by a time-of-flight apparatus. Neutron spectra from the bombardment of tritium and deuterium by deuterons are shown. (B.J.H.)

NUCLEAR REACTORS

11462 AERE-NURG/M-38

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE PILE-STEAM TURBINE COMBINATION. O. Pulley. July 24, 1952. 15p.

Because pressure, temperature and enthalpy at all points in a simple steam cycle are determined by the maximum steam temperature, turbine efficiency and condenser conditions and because the two latter vary little in practice, it can be shown that all relevant pile coolant temperatures are unique functions of the maximum steam temperature

T_1. Operating conditions for both steam plant and coolant channel are drawn up on this basis for a range of T_1 from 300° to 900°F. The expected operating pressure, output, etc., for the system is determined by introducing the limits set by maximum sheath temperature and by available fin designs. It is unlikely that steam pressures greater than 170 lbs/in.^{2} absolute can be achieved until better fin systems are available. (auth)

11463 AERE-NURG/M-54
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE CHOICE OF STEAM CYCLE FOR USE WITH A PILE. O. Pulley. Mar. 12, 1953. 21p.

The work output theoretically obtainable from a fluid of constant specific heat, receiving heat over a given temperature range and rejecting it at a lower temperature, is reduced by imperfections in a practical engine. Combining this reduced output with fuel and capital costs which are believed to be attainable, it is found that an optimum temperature range exists for which the unit cost of available power is a minimum. With conditions applicable to a natural U, graphite moderated, gas cooled pile using Al fuel sheathing, the optimum coolant range is approximately from 280 to 610°F. A two pressure steam cycle with economiser designed for this coolant temperature range would generate roughly equal quantities of steam at 70 and 400 psia and give an over-all efficiency of 21%. The use of three pressures gives a small improvement; more than three pressures would not be profitable. Bled steam feed heating, although perhaps convenient, is not justified by the simple economics. (auth)

11464 AERE-R/R-1940
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE EFFECT OF REMOVING PLATE FUEL ELEMENTS UPON THE THERMAL NEUTRON FINE STRUCTURE IN REACTOR ASSEMBLIES. PART I. D. A. Newmarch. July 1956. 14p.

By means of diffusion theory, an expression has been derived for the thermal neutron fine structure in an infinite reactor assembly where the fuel elements are in the form of plates, some of which have been removed and the resultant gap filled with moderator. (auth)

11465 AERE-T/M-5
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
APPROACH TO CRITICALITY: REFINEMENTS IN THE CALCULATIONS. O. Buneman. June 11, 1948. 5p.

The refined analysis of the problem of approach to criticality shows marked deviations from the original approximate estimates. However, the method of refinement used here is inclined to overestimate the corrections. Further work is necessary, in particular the approximate boundary condition used here ought to be replaced by a more exact one and two-group theory ought to be used throughout. It may be possible that an exact enough analysis of the problem of subcritical assemblies can be used in order to predict critical sizes adequately from as little as 10 tons of uranium. However, further work on the theory can only be justified if the accuracy of measurements can keep step with it. (auth)

11466 AERE-T/M-46
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
CALCULATION OF THE THERMAL FINE STRUCTURE IN A PILE WITH HOLLOW RODS BY THE SPHERICAL HARMONICS METHOD. M. E. Mandl. Mar. 16, 1951. 11p.

The thermal fine structure is calculated by the spherical harmonics P_3 approximation, for a typical lattice cell containing a hollow rod and moderator with an air gap, using a previously given theory. The density distribution and the thermal utilization factor f are calculated for one set of typical dimensions for an enriched reactor and compared with those obtained by diffusion theory. (auth)

11467 AERE-T/M-137
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
AN ESTIMATION OF THE DOPPLER EFFECT IN FAST NEUTRON REACTORS. A. M.Lane, J. E. Lynn, and J. S. Syory. July 1956. 45p.

An attempt is made to improve the estimates of temperature coefficient of reactivity effects in fast reactors. Numerical estimates are based on assumed statistical distributions of resonance level parameters, using only U^{235} and U^{238} thermal neutron data. Justification for the assumptions is presented. (D.E.B.)

11468 BNL-144
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] NOVEMBER 1951. R. W. Powell. Decl. Sept. 21, 1956. 13p. $3.30(ph OTS); $2.40(mf OTS).

Operation schedule, reactivity inventory, leak-rate tabulations, experimental facilities' utilization, and power levels of the Brookhaven Reactor are reported. Instrument maintenance and health physics operations are discussed. (C.W.H.)

11469 BNL-150
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] DECEMBER 1951. R. W. Powell. Decl. Sept. 21, 1956. 11p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-144.)

11470 BNL-160
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] JANUARY 1952. R. W. Powell. Decl. Sept. 21, 1956. 16p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-150.)

11471 BNL-165
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] FEBRUARY 1952. R. W. Powell. Decl. Sept. 21, 1956. 15p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-160.)

11472 BNL-181
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] APRIL 1952. R. W. Powell. Decl. Sept. 21, 1956. 16p. $3.30(ph OTS); $2.40(mf OTS).

11473 BNL-185
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] MAY 1952. R. W. Powell. Decl. Sept. 21, 1956. 16p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-181.)

11474 BNL-198
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] AUGUST 1952. R. W. Powell. Decl. Sept. 21, 1956. 18p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-193.)

11475 BNL-204
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT

[FOR] SEPTEMBER 1952. R. W. Powell. Decl. Sept. 21, 1956. 15p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-198.)

11476 BNL-208
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] OCTOBER 1952. R. W. Powell. Decl. Sept. 21, 1956. 15p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-204.)

11477 BNL-218
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] DECEMBER 1952. R. W. Powell. Decl. Sept. 21, 1956. 17p. $3.30(ph OTS); $2.40(mf OTS).

11478 BNL-226
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] JANUARY 1953. R. W. Powell. Decl. Sept. 21, 1956. 16p. $3.30(ph OTS); $2.40(mf OTS).
The operating characteristics of the Brookhaven Reactor are presented. Miscellaneous data are included. (For preceding period see BNL-218.) (W.L.H.)

11479 BNL-230
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] FEBRUARY 1953. R. W. Powell. Decl. Sept. 21, 1956. 15p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-226.)

11480 BNL-233
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] MARCH 1953. R. W. Powell. Decl. Sept. 21, 1956. 15p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-230.)

11481 BNL-238
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] APRIL 1953. R. W. Powell. Decl. Sept. 21, 1956. 15p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-233.)

11482 BNL-245
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] JUNE 1953. R. W. Powell. Decl. Sept. 21, 1956. 15p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-241.)

11483 BNL-248
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] JULY 1953. R. W. Powell. Decl. Sept. 21, 1956. 18p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-245.)

11484 BNL-253
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] AUGUST 1953. R. W. Powell. Decl. Sept. 21, 1956. 17p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-248.)

11485 BNL-261
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] SEPTEMBER 1953. R. W. Powell. Decl. Sept. 21, 1956. 18p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-253.)

11486 BNL-272
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] NOVEMBER 1953. R. W. Powell. Decl. Sept. 21, 1956. 16p. $3.30(ph OTS); $2.40(mf OTS).

11487 BNL-277
Brookhaven National Lab., Upton, N. Y.
REACTOR OPERATIONS DIVISION MONTHLY REPORT [FOR] DECEMBER 1953. R. W. Powell. Decl. Sept. 21, 1956. 19p. $3.30(ph OTS); $2.40(mf OTS).
(For preceding period see BNL-272.)

11488 CF-54-6-232
Oak Ridge National Lab., Tenn.
CHEMICAL TREATMENT FOR THE HRT STEAM SYSTEM. R. B. Korsmeyer. June 30, 1954. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).
A chemical treatment for the HRT steam generating system is proposed which avoids the addition of metallic ion to the boiler feed water by taking advantage of the most modern boiler practice for central power stations. Oxygen in the feed water is destroyed (if necessary) with hydrazine added at the feed water storage and the pH of the whole steam system is controlled between 7 and 9 with a neutralizing amine, such as morpholine, which also binds CO_2 if present. Oxygen accumulation at the condensers (due to generation in the boilers) is held to concentrations not exceeding 800 ppm at 140 psia total pressure, by suitable bleed off, to insure that the O_2 in the condensate does not exceed 0.1 ppm. The maximum bleed rate at these conditions would be about 40 lbs/hr for a total steaming rate of 20,000 lbs/hr. Due to the extremely high O_2 concentration in the steam at the condensers it is suggested that provision be made to introduce filming amines, such as octadecyl amine, into the steam lines at some convenient point before the condensers. The filming amine would be added only after evidence that the other treatment was not adequate. (auth)

11489 CF-56-6-115
Oak Ridge National Lab., Tenn.
EXAMINATION OF THE NORTH CAROLINA STATE COLLEGE REACTOR CORE. A. R. Olsen and A. E. Richt. July 20, 1956. 25p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).
The postfailure examination of the North Carolina State College Reactor revealed a failure of the core wall in a very localized region just above the liquid level. The apparent cause of failure was a pitting type of corrosion. The failure of the cooling system was not located, but several possible sources of failure were observed metallographically. (auth)

11490 CRRP-655
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
COMPARISON OF THEORY AND EXPERIMENT FOR: (A). LATTICE PROPERTIES OF D_2O–U REACTORS. (B). CENTRAL ROD EXPERIMENTS. (C). FOREIGN ROD EXPERIMENTS. E. Critoph. Appendix by A. G. Ward. July 26, 1956. 65p. (AECL-350).
A new system of lattice calculations is presented which uses new methods of calculating ϵ and p. With this system of calculating lattice properties, fairly good agreement with ZEEP and NRU lattice experiments, using in all cases (including η) the "best" values of nuclear constants can be obtained. The central rod experiments seem to tie in fairly well with these ideas and tend to substantiate them. (auth)

11491 GER-7648
Goodyear Aircraft Corp., Akron, Ohio.
NUCLEAR REACTOR AND POWER PLANT SIMULATOR. N. P. Tomlinson. May 23, 1956. 49p.
A nuclear reactor and power plant simulator was developed to give the atomic energy industry a convenient, rapid, and accurate means of analyzing and designing any

type reactor, power plant, and control system. This special-purpose analog computer solves the equations describing the complete reactor system. The performance of the reactor power plant and control system can be evaluated from the recording of the system variables, represented in the simulator by d-c voltages. By this means, transient and stability studies can be made. System parameters, initial values, and input functions can be changed conveniently by simple adjustments of the simulator setup. The simulator also can be used to train reactor operators. (auth)

11492 LA-399

[Los Alamos Scientific Lab., N. Mex.]

THEORY OF WATER-TAMPED WATER BOILER. E. Greuling, H. Argo, M. Argo, G. Chew, M. Frankel, E. J. Konopinski, C. Marvin, and E. Teller. Sept. 27, 1945. Decl. Aug. 25, 1955. 56p. Contract [W-7405-eng-36]. $9.30(ph OTS); $3.60(mf OTS).

The critical mass of the water-tamped 14 percent enriched uranyl sulfate water boiler calculated by integral diffusion theory is 1.31 ± 0.10 kg of U^{235}. The calculated thermal neutron distribution in core and tamper of the under critical boiler containing 717 gms of 25 and a Ra Be source agrees with the measured distribution. Simple formulae and curves appropriate for water-tamped spherical, infinite cylindrical, and plane slab hydride cores are applied to the calculation of the minimum critical mass and the minimum critical dimensions of the above type boilers. (auth)

11493 NAA-SR-1622

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SODIUM GRAPHITE REACTOR QUARTERLY PROGRESS REPORT [FOR] JANUARY–MARCH 1956. SECTION A. L. E. Glasgow, ed. SECTION B. J. C. Cochran, ed. July 15, 1956. 88p. Contract AT(04-3)-49. $13.80(ph OTS); $4.80(mf OTS).

Reactivity and flux perturbation studies for SRE are reported. Additional experiments were conducted to determine the behavior of Zr in liquid Na. Weight gain as a function of time and temperature is plotted. Tests were made on Hf-free Zr which show the effects of surface oxide on the fatigue and rupture properties and the effects of temperature on tensile properties. These functions are plotted. Analog computer studies of convective flow in the SRE after shutdown indicate satisfactory heat removal. Coolant flow decay for the case of simultaneous pump failure and scram is plotted. Moderator can fabrication and stress studies resulted in revised fabrication techniques and a reconsideration of can stress tolerances. Previously obtained fuel element orifice calibration data were translated to show pressure drop-flow rate and discharge coefficient–Reynold's number relationships. Results of tests on control rod drive mechanism components are reported and discussed. Excessive wear continues to appear. The status of various shielding studies is reviewed. (For preceding period see NAA-SR-1582.) (D.E.B.)

11494 WAPD-CTA(CE)-47

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PHOTOELASTIC TESTS OF PRESSURE VESSEL CLOSURES. B. F. Langer. Nov. 16, 1955. 5p. Project 90604. Contract NObs-67500.

Recommendations for, and discussion of, the investigative program for perforated pressure vessel heads are presented. (T.R.H.)

11495

THE PREVENTION OF UNWANTED CRITICALITY. A. H. Gillieson (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Eng. 1, 186-90(1956) Aug.

The main factors affecting critical mass, and thus nuclear safety, are shape, neutron moderation, concentration of fissile material in solution, neutron reflection, density charge, dilution, and interaction of units containing fissile material. These are considered in the light of their effects on handling, processing, fabrication, transport and storage of fissile material. (auth)

11496

THE WORLD'S REACTORS. NO. 4. DIMPLE. Nuclear Eng. 1, 192a(1956) Aug.

Design specifications and a cutaway view of DIMPLE, a deuterium-moderated low-energy reactor, are given. (F. S.)

11497

SCIENTIFIC PROBLEMS IN THE DEVELOPMENT OF NUCLEAR POWER. Nuclear Eng. 1, 193-4(1956) Aug.

Further research into the physics, chemical and metallurgical problems of power reactor design will lead to higher burn-up figures, higher temperatures and efficient conversion and breeding. Subjects for future experimentation are discussed in the light of present-day experience. (auth)

11498

THE FUELLING OF NUCLEAR REACTORS. F. W. Fenning (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Eng. 1, 195-7(1956) Aug.

In a reactor system neutrons are produced, heat is liberated, fuel is burnt and further fuel may be produced. These functions are necessarily interrelated and the choice of a particular reactor system will depend upon the material available and the ultimate purpose of the reactor. (auth)

11499

AMERICAN PRIVATE RESEARCH REACTOR. Nuclear Eng. 1, 198-9(1956) Aug.

The 50 kw homogeneous reactor built by Atomics International for private industrial research is now in operation at the Illinois Institute of Technology. It will be used mainly for irradiation research and on-the-spot production of short-lived isotopes, and will be operated by the Armour Research Foundation for the 24 industrial companies financing it. (auth)

11500

SMALL LIQUID METAL FUELED REACTOR SYSTEMS. Jack Chernick (Brookhaven National Lab., Upton, N. Y.). Nuclear Sci. and Eng. 1, 135-55(1956) May.

Nuclear properties and potentialities of small liquid metal fueled reactors using Pu fuel, Bi as carrier, and Be as a moderator are given. The use of liquid metal fueled reactors as neutron or power producers with emphasis on small reactor cores is discussed. (F.S.)

11501

A PRELIMINARY STUDY OF SUPERHEATING BOILING REACTORS. M. Treshow (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 1, 167-73(1956) May.

The principles of gas-cooled and of boiling water reactors are combined in a preliminary study of the thermal characteristics of a reactor which can generate superheated steam. Heat transfer relations are developed and applied to a tubular fuel element of a reactor producing 10 Mw in the form of steam at 600 psi and 700°F. (auth)

11502

FISSION AND ACTIVATION RATIOS IN THE EBR. S. G. Kaufmann, F. S. Kirn, and W. B. Loewenstein (Argonne National Lab., Lemint, Ill.). Nuclear Sci. and Eng. 1, 193-203(1956) July.

Miniature fission counters and thin foils are employed to

determine the ratios of the effective neutron cross sections for fission and activation of elements of interest at various locations in the Experimental Breeder Reactor at Arco, Idaho. Experimental results are compared with predictions based on multigroup diffusion theory. (auth)

11503

LONG TERM VARIATION IN COMPOSITION AND NEUTRON YIELD IN PILE PLUTONIUM. Arthur H. Jaffey (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 1, 204-15(1956) July.

The neutron economy of a thermal reactor or system of reactors using Pu^{239} as fuel for long time periods is examined. In the first case treated, only the change in neutron absorption and production due to plutonium isotope growth is considered. In the second, and more complete case, the effect of neutron absorption by fission products is included. Both analyses are developed in terms of an idealized system in which: (1) a uniform and constant flux of 3×10^{14} neutrons/cm^2/sec is assumed; (2) the Pu^{239} level is kept constant by internal regeneration or from external sources; (3) neutron escape and neutron capture by structure, moderator, and coolant are neglected; (4) excess neutrons beyond those needed to propagate the chain are absorbed in the fertile material, U^{238}, to regenerate Pu^{239}, and (5) contributions to the neutron economy from U^{238} and U^{235} fission are not included. In the first case (omitting fission product absorption), the system is found to be approximately regenerative, i.e., at equilibrium, about as much Pu^{239} is formed as is destroyed. In the second case (including fission products), the regenerative properties become relatively poor unless fission products are removed periodically. A particular processing cycle is examined, in which chemical separations occur at 0.2-year intervals (nvt = 2×10^{21} neutrons/cm^2) and is found to yield an almost regenerative system, so that relatively little Pu^{239} has to be supplied from external sources. (auth)

11504

LIMITATIONS OF MULTIGROUP CALCULATIONS. Carl Klahr (Nuclear Development Corp. of America, White Plains, N. Y.). Nuclear Sci. and Eng. 1, 253-67(1956) Aug.

Multigroup calculations of neutron flux and current in the reflector of a thermal reactor may be seriously in error at intermediate neutron energies. This is a consequence of the assumed linear flux variation with lethargy within each group that is implicit in the multigroup method. As a result, most multigroup treatments show marked deviations from age theory at distances of several slowing down lengths (or more) from the source region. Calculations have been made to show the variation of the error in a particular multigroup treatment as a function of distance from the source (measured in slowing down lengths) and of the number of groups. (auth)

11505

THE THERMAL NEUTRON FLUX IN A SQUARE LATTICE CELL. E. Richard Cohen (Atomics International, Canoga Park, Calif.). Nuclear Sci. and Eng. 1, 268-79(1956) Aug.

The neutron distribution in the moderator of an infinite square-lattice array is found assuming diffusion theory and a uniform production of neutrons throughout the moderator. Variation of neutron flux density along the sides of a lattice cell is shown to be significant. Nevertheless, the thermal utilization of the lattice can be quite accurately calculated by the use of a "cylindricalized" cell. (auth)

11506

NEUTRON THERMALIZATION. I. HEAVY GASEOUS MODERATOR. H. Hurwitz, Jr., M. S. Nelkin, and G. J. Habetler (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 1, 280-312(1956) Aug.

The approximation of a heavy gaseous moderator is used as an illustrative example for the discussion of calculational methods in the thermal and epithermal energy regions. The energy distribution and migration area of neutrons in a infinite homogeneous medium are calculated numerically for 1/v absorption. Semianalytic expressions are obtained for the case of weak absorption. Finally, an expression for the slowing-down density is given and its significance for the modification of age-diffusion theory to include the thermal motion of the moderator is discussed. (auth)

11507

HOMOGENEOUS HEAVY WATER MODERATED CRITICAL ASSEMBLIES. PART 1. EXPERIMENTAL. Richard N. Olcott (Los Alamos Scientific Lab., N. Mex.). Nuclear Sci. and Eng. 1, 327-41(1956) Aug.

Ten critical assemblies of enriched uranyl fluoride heavy-water solutions have been studied. In six cases, heavy water reflectors surrounded solutions in which the atomic ratio of deuterium to uranium-235 varied from 34 to 430. The remaining four assemblies were without reflector and the deuterium to U^{235} ratio ranged from 230 to 2080. Activation rates within the systems were measured for the resonance detectors In, Au, Pd, and Mn and for the fission detectors U^{235}, U^{238}, Pu^{239}, and U^{233}. (auth)

11508

THE GAS TURBINE IN ATOMIC ENERGY. J. E. B. Perkins. Nuclear Power 1, 108-13(1956) July.

The efficiency of the simple gas-turbine cycle, being highly temperature-dependent, limits the selection of reactor to those in which a temperature of at least 500°C can be maintained for continuous operation. With more complex cycles the choice is wider. Possible reactor-turbine systems are discussed and tentative evaluations made of the various combinations of thermal and fast reactors with open- and closed-cycle turbines. Of the possible gases considered, air is considered the best. An attempt is made to visualise how the gas turbine might be used for land, sea and air application. (auth)

11509

CONTROL OF NUCLEAR REACTORS. R. J. Cox (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Power 1, 114-17(1956) July.

The multiplication factor and reactivity of a reactor are explained and defined and methods described for controlling them, taking into account the effects of delayed and photo neutrons. The solution of the reactor kinetic equation is discussed and the importance of the reactor transfer function emphasized. Changes in reactivity during operation due to depletion of fuel and poisoning are mentioned, and the principles of automatic control are developed. (auth)

11510

THE PRODUCTION OF REACTOR FUEL ELEMENTS. III. L. M. Wyatt. Nuclear Power 1, 125-9(1956) July.

The method of developing BEPO type cans is explained in detail and other types are briefly explained. The differences between British and American fuel plate designs are noted. The physical properties of Pu metal are given. (F.S.)

11511

REACTOR PHYSICS. 3. James F. Hill (Reactor School, Harwell, Berks, England). Nuclear Power 1, 133-7(1956) July.

The boundary conditions on solutions of the diffusion equation are first discussed. These are then applied in turn to the solution of the equation for a plane source in an infinite medium, a plane source in a finite medium and a point source in an infinite medium. The practical implications of these solutions are discussed, including the physical interpretation of the diffusion length. The calculation of the diffusion length in the particular case of beryllium oxide is discussed in detail and finally a table of values of diffusion lengths and other important diffusion quantities is given. (auth)

11512
CONTROL OF NUCLEAR REACTORS. R. J. Cox (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Power 1, 161-4(1956) Aug.

The multiplication factor and reactivity of a reactor are explained and defined and methods described for controlling them, taking into account the effects of delayed and photo neutrons. The solution of the reactor kinetic equation is discussed and the importance of the reactor transfer function emphasised. Changes in reactivity during operation due to depletion of fuel and poisoning are mentioned and the article concludes with the development of automatic control. (auth)

11513
DIDO—HEAVY WATER RESEARCH REACTOR. Nuclear Power 1, 165-8(1956) Aug.

DIDO, a heavy water research reactor, with a maximum thermal neutron flux of 10^{14} neutrons/cm^2/sec, will be used as a tool for reactor research and development and a source of isotopes of high specific activity. The fuel elements, thermal shield, controls, and hot laboratory facilities are discussed. (F.S.)

11514
WHERE REACTOR DEVELOPMENT STANDS TODAY. James A. Lane (Oak Ridge National Lab., Tenn.). Nucleonics 14, No. 8, 30-7(1956) Aug.

A survey is presented of non-U. S. and U. S. power programs. Power reactor types are discussed along with the technical feasibility of power reactors. (W. L. H.)

11515
POWER REACTOR EXPERIMENTS. Nucleonics 14, No. 8, 38-53(1956) Aug.

A report is presented on the power reactors that are either in the process of being built or are already in operation. Operating procedures are outlined along with their designs. (W. L. H.)

11516
ORGANIC COOLANT-MODERATORS FOR POWER REACTORS. G. A. Freund (Argonne National Lab., Lemont, Ill.). Nucleonics 14, No. 8, 62-4(1956) Aug.

An evaluation of organics as coolant-moderators for power reactors is presented. The advantages and disadvantages of diphenyl are listed with the effects of its use on plant design. (W. L. H.)

11517
SUBCRITICAL REACTOR IN A PICKLE BARREL—NYU'S TRAINING TOOL. L. B. Borst (New York Univ., New York). Nucleonics 14, No. 8, 66-8(1956) Aug.

Subcritical systems provide safe, inexpensive tools for teaching and simple experimentation. The New York University subcritical "pickle barrel" is described. (auth)

11518
INDIAN POINT PLANT ENTERS CONSTRUCTION PHASE. Nucleonics 14, No. 8, 70-3 & 117(1956) Aug.

Consolidated Edison's plans to start construction on a nuclear steam-generating plant at Indian Point, N. Y. are described. Reactor specifications are presented. (W. L. H.)

11519
WHO'S WHO IN THE AIRCRAFT NUCLEAR PROGRAM. John E. Kenton. Nucleonics 14, No. 8, 74-6(1956) Aug.

The industrial contractors now involved in the aircraft nuclear program are listed. (W. L. H.)

11520
TEMPERATURE COEFFICIENT OF AIRCRAFT SHIELD TEST REACTOR. J. C. Nance (General Dynamics Corp., Fort Worth, Tex.). Nucleonics 14, No. 8, 98(1956) Aug.

The temperature coefficient of reactivity of Convair's Aircraft Shield Test Reactor has been measured for two core loadings. The results are presented. (W. L. H.)

11521
A GAS-COOLED HEAVY WATER POWER REACTOR. A. I. Alikhanov, V. V. Vladimirskii, P. A. Petrov, and P. I. Khristenko. Soviet J. Atomic Energy, No. 1, 3-6(1956).

Designs for a proposed gas-cooled heavy water reactor are briefly described. (B. J. H.)

11522
THE REACTOR OF THE U.S.S.R. ACADEMY OF SCIENCES ATOMIC POWER STATION. D. I. Blokhintsev, N. A. Dollezhal, and A. K. Krasin. Soviet J. Atomic Energy, No. 1, 7-20(1956).

The preliminary studies on the atomic power station in the USSR are briefly outlined. The nucleus of the reactor consists of a cylindrical graphite stack containing vertical holes for the U fuel elements. The reactor is H_2O cooled and controlled by boron carbide rods. The power plant has operated satisfactorily since June 1954. (B. J. H.)

11523
PHYSICAL AND THERMAL CALCULATIONS FOR THE U.S.S.R. ACADEMY OF SCIENCES ATOMIC POWER STATION REACTOR. D. I. Blokhintsev, M. E. Minashin, and Yu. A. Sergeev. Soviet J. Atomic Energy, No. 1, 21-41 (1956).

The physical and thermal calcualtions on the atomic power station reactor are summarized. (B. J. H.)

NUCLEAR TRANSFORMATION

11524 NYO-6627
Carnegie Inst. of Tech., Pittsburgh.
SPALLATION YIELDS FROM CHLORINE WITH 45-430 MEV PROTONS; A SEARCH FOR UNKNOWN MEDIUM-LIGHT EVEN-EVEN NUCLIDES; AND BETA LIFETIME STATISTICS (thesis). John W. Jones. May 26, 1956. 114p. Contract AT(30-1)-844.

The Carnegie synchrocyclotron was used in attempts to find unknown radionuclides in the medium-light even elements. Proton spallation products of targets from Mg to Cu were examined for unknown even-even nuclides. The exclusion limits of half life of several nuclides are reported and discussed. The half lives of β-labile nuclides near stability below Bi were compiled and some statistical studies made. (T.R.H.)

11525
DIFFERENTIAL CROSS-SECTIONS FOR PHOTOPRODUCTION OF POSITIVE PIONS IN HYDROGEN. I. LOW ENERGIES. M. Beneventano, D. Carlson-Lee, G. Stoppini, and L. Tau (Univ. of Rome) and G. Bernardini (Univ. of Illinois, Urbana). Nuovo cimento (10) 4, 323-56(1956) Aug.

The cross-sections $\sigma(E_\gamma,\varphi)$ for the reaction $p^\gamma \rightarrow n^+$ have been measured near threshold as a function of photon energy and at four angles. These results combined with previously known data, have given a fairly complete and accurate description of $\sigma(E_\gamma,\theta)$ between the limits $30° \leq \theta \leq 180°$ and $170 \leq E_\gamma \leq 270$ Mev. Writing $\sigma(E_\gamma,\theta) = W\{a_0 + a_1 \cos\theta + a_2 \cos^2\theta\}$ with $W = \eta\omega\{1 + (\mu/E_i)\nu\}^{-1}\{1 + (\mu/E_f)\omega\}^{-1}$ the experimental data indicate that a_0 is constant up to about $E_\gamma \cong 260$ Mev; and that the three a_i coefficients analyzed in terms of S and P waves give a very small spin flipping P-amplitude K. The presumption that the S amplitude E_1 is mainly due to the gauge invariance requirement is definitely not consistent with the data. A discussion based on the Kroll and Rudermann theorem leads to the conclusion that this inconsistency may be eliminated if allowance is made for the contribution of fairly large nucleon recoils. However, it turns out that only the changing sign part of these recoils is really large and apparently so up to terms of order higher than μ/M. The amount of the recoil at threshold is estimated and consequently a value for the pspv interaction constant is derived. (auth)

11526

FAST PHOTONEUTRONS FROM BISMUTH. F. Ferrero, A. O. Hanson, R. Malvano, and C. Tribuno (Istituto di Fisica dell'Universita, Torin). Nuovo cimento (10) 4, 418-29(1956) Aug.

The excitation functions for fast photoneutrons from bismuth are observed with (n,p) detectors. These indicate that the fast neutrons are produced predominantly by photons in the region of the giant resonance giving further experimental evidence that the giant resonance can be attributed to strong individual particle transitions rather than a collective type of photon absorption resulting in a general nuclear heating. The experimental angular distribution of the fast neutron component from the giant resonance is in agreement with that expected for shell model transitions. The relative number of fast neutrons was found to be about 7% of the total neutron yield. This is consistent with the idea that individual neutrons are excited from upper closed shell levels in the continuum if one takes account of the interaction of the neutrons in these states with the rest of the nucleus, as in the model of Feshbach. Porter and Weisskopf. (auth)

11527

APPLICATION OF ADIABATIC FUNCTIONS TO $N^{14} + N^{14}$ REACTIONS. Marvin E. Ebel (Yale Univ., New Haven, Conn.). Phys. Rev. 103, 958-61(1956) Aug. 15.

Nucleon tunneling in reactions of the type $N^{14}(N^{14},N^{13})N^{15}$ and $N^{14}(N^{14},C^{13})O^{15}$ is calculated by using adiabatic wave functions constructed by the well-depth eigenfunction method. The procedure is applicable only if resonance effects in the transfer do not enter; in this case the results are shown to be equivalent with those obtained in the more detailed considerations of the energy.matrix method. (auth)

11528

ANISOTROPIC PHOTOFISSION. E. J. Winhold and I. Halpern (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 103, 990-1000(1956) Aug. 15.

The angular distribution of photofission fragments with respect to the direction of a high-energy x ray beam has been found to be anisotropic. The distribution seems to be of the same form, $a + b \sin^2\theta$, in a large variety of situations. The ratio of b to a depends on the energy of the photons producing the fission, on the particular fissionable target being irradiated, and on the particular fission fragments being observed. The photofission excitation curve is compared with the (γ,n) excitation curve in the energy region near the fission threshold where the fission anisotropy seems to be largest. Recent attempts to develop a theory of anisotropic fission are briefly discussed. (auth)

11529

THE YIELD AND ANGULAR DISTRIBUTION OF NEUTRONS FROM THE REACTION $^{63}Cu(p,n)^{63}Zn$ AT 18 MEV. D. M. Thomson (Makerere Coll., Kampala, Uganda, East Africa). Proc. Phys. Soc. (London) A69, 447-52(1956) June 1.

The yield of neutrons from the reaction $Cu^{63}(p,n)Zn^{63}$ at 18 Mev has been measured at five angles to the incident proton direction, using nuclear emulsions to detect the neutrons. The anisotropic angular distributions, which show some preference for the forward direction, and the shape of the neutron energy spectrum, provide some further evidence that the statistical compound nucleus model does not completely account for reactions of this type. The total (p,n) cross section was estimated to be 2×10^{-25} cm^2, in agreement with the value found by Ghoshal at this energy. (auth)

11530

THE CAPTURE CROSS SECTION OF NEUTRONS BY BORON. C. H. Collie and R. E. Meads (Clarendon Lab., Oxford, England) and E. E. Lockett (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A69, 464-8(1956) June 1.

The capture cross section of natural boron for slow neutrons has been measured by a dynamic method, in which the decay constant of neutrons in a water tank was plotted against the concentration of added borax. Samples were compared with a standard boron oxide in GLEEP at the Atomic Energy Research Establishment, Harwell. The result is quoted as $\sigma_B = 760 \pm 3$ barns for the A.E.R.E. sample of natural boron oxide. (auth)

11531

THE CAPTURE CROSS SECTION OF THERMAL NEUTRONS IN WATER. R. E. Meads, C. J. England, C. H. Collie, and G. C. Weeks (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A69, 469-79(1956) June 1.

The capture cross section of slow neutrons by protons has been measured by following the decay of neutrons from a pulsed source in water. The decay was measured by detecting the capture γ rays with a liquid scintillator. The observed average life in water was 203.3 ± 2.6 μsec corresponding to a capture cross section of 0.335 ± 0.004 barns at a velocity of 2200 meters/sec. (auth)

11532

INVESTIGATION OF THE NEUTRON YIELD OF REACTION D(d,n) He BY THE BOMBARDMENT OF METALS WITH DEUTERONS. Klaus Fiebiger. Z. Naturforsch. 11a, 607-8 (1956) July. (In German)

11533

ACTIVATION ANALYSIS WITH CHARGED PARTICLES. Erik Odeblad. Acta Radiol. 45, 396-402(1956) May.

Certain basic physical principles underlying the method of activation analysis using charged particles are presented. Special attention is drawn to the implications of cross section dependence on energy, and energy loss of charged particles. Examples of their application are given. (auth)

11534

EXCITATION CURVES OF THE REACTION $^{16}O(d,p)$ $^{17}O^*$. M. Roclawski-Conjeaud and E. Cotton (C.E.N., Saclay, France). Nuclear Phys. 1, 603-9(1956) July. (In French)

Excitation curves of the reaction $O^{16}(d,p)$ O^{17*} (875-kev level) are given at angles 10 and 135° in the laboratory system for deuteron energies between 1.7 and 4.5 Mev. (auth)

11535

THE YIELDS OF THE CHEMICAL ELEMENTS IN THERMAL NEUTRON FISSION OF U-235. Mark T. Robinson and Joseph F. Krause (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 1, 216-21(1956) July.

The yields of most of the chemical elements occurring in thermal neutron fission of U^{235} have been calculated from available data on mass yields, radioactive half lives, and decay schemes of fission product nuclides. The results of the computations are presented graphically. (auth)

11536

GAMMA RADIATION ACCOMPANYING THE ABSORPTION OF FAST PROTONS BY NUCLEI. A. I. Akhiezer and I. Ia. Pomeranchuk (Physical Tech. Inst.). Soviet Phys. JETP 3, 127-8(1956) Aug. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 201-3(1956) Jan. (In Russian)

The mechanisms for γ radiation following nuclear absorption of fast protons are discussed. (B.J.H.)

Refer also to abstract 11596.

PARTICLE ACCELERATORS

11537 UCRL-1369
California. Univ., Berkeley. Radiation Lab.
A LOW VOLTAGE ION SOURCE. John S. Foster, Jr., and Eugene F. Martina. July 12, 1951. Decl. May 17, 1956. 42p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

An investigation of a particular method of extracting ions from an arc is described, and experimental results of a low extraction voltage ion source are given. This source delivers a 6-kv ion beam of 0.6 A per in.^{2} at the source, having a total angular divergence to half intensity points of 9 to 12°. An appendix gives the results of a few simple experiments to show the characteristics of axial extraction, and considers the merits of several forms that have been tried. (auth)

11538 UCRL-3463
California. Univ., Berkeley. Radiation Lab.
BEAM STORAGE IN THE 184-INCH CYCLOTRON. Frank S. Crawford, Jr. and Warren Fenton Stubbins. July 9, 1956. 34p. Contract W-7405-eng-48. $0.30(OTS).

The storage within a circular machine of a large number of particles accumulated during many acceleration cycles was investigated. The equations of motion of particles in a circular machine and the factors that attenuate a circulating beam were studied. (F.S.)

11539
CYCLOTRON INSTRUMENTATION FOR NUCLEAR SPECTROSCOPY AT MEDIUM RESOLUTION IN ENERGY. D. R. Bach, W. J. Childs, R. W. Hockney, P. V. C. Hough, and W. C. Parkinson (Univ. of Michigan, Ann Arbor). Rev. Sci. Instr. 27, 516-26(1956) July.

The instrumentation for the magnetic focusing and analysis of the external beam of the Michigan cyclotron is described. It provides to a scattering chamber in an adjacent room a beam of deuterons of a few tenths microampere monoenergetic to within 15 kev at a mean energy of 7.8 Mev. A double-focusing analyzer magnet of mean radius one meter, focuses reaction products of magnetic rigidity less than or equal to that of a 20-Mev proton. At the optimum energy resolution of the system, proton groups from (d,p) reactions differing in Q by about 20 kev can be resolved. Particles can be observed over a continuum of angles from −7° to +112° relative to the incident beam. The determination of reaction energies and the measurement of relative differential cross sections are discussed. (auth)

11540
CONTROL AND MEASUREMENT OF AN ION SOURCE OF A PRESSURE INSULATED VAN DE GRAAFF GENERATOR. A. G. de Boer, J. Kley, and J. H. Makkink (Technical Univ. of Delft, Netherlands). Rev. Sci. Instr. 27, 614-18(1956) Aug.

A very simple method has been developed for the control and measurement of an ion source in the top terminal of a high pressure insulated Van de Graaf generator. The sending and receiving of information from the outside of the tank to the high voltage electrode is achieved by means of light signals. (auth)

11541
EXPERIMENTAL TEST OF THE FIXED FIELD ALTERNATING GRADIENT PRINCIPLE OF PARTICLE ACCELERATOR DESIGN. L. W. Jones and K. M. Terwilliger (Univ. of Michigan, Ann Arbor) and R. O. Haxby (Purdue Univ., Lafayette, Ind.). Rev. Sci. Instr. 27, 651-2(1956) Aug.

Particles may be accelerated in an annular ring machine with a magnetic guide field constant in time, using alternating gradient focusing. This is verified by achievement of an accelerated beam in an electron model which is described and discussed. (T. R. H.)

11542
C.E.R.N.—EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH. Nuclear Eng. 1, 200-2(1956) Aug.

Set up in 1954, the Organization's primary object is to provide scope for collaboration between European countries in the field of nuclear research on a large scale. The main effort is being concentrated on the construction of a proton-syncrotron and a syncro-cyclotron. (auth)

11543
EXPERIMENTAL EVALUATION OF THE PHYSICAL CHARACTERISTICS OF A 45-MEV MEDICAL LINEAR ELECTRON ACCELERATOR. C. L. Hsieh and Erich M. Uhlmann (Michael Reese Hospital, Chicago). Radiology 67, 263-72(1956) Aug.

Essential characteristics of high-energy external electron beams produced by a traveling-wave linear accelerator were studied experimentally. The principles of design and the performance of the magnet system used for the control of the energy, direction, and dimensions of the electron beam are outlined. Depth-dose curves from electron beams of various energies were obtained, and the effect of beam size on the distribution of ionization was studied. Stray radiations associated with the operation of the accelerator were measured for evaluation of safety during therapeutic applications. (auth)

11544
PRINCIPLES OF ACCELERATION OF CHARGED PARTICLES. V. A. Veksler. Soviet J. Atomic Energy, No. 1, 77-83(1956).

The basic principles of various cyclic charged-particle accelerators are reviewed. (B. J. H.)

11545
EXCITATION OF SYNCHROTRON DUE TO ELECTRON RADIATION FLUCTUATION IN STRONG FOCUSING ACCELERATORS. A. A. Kolomenskii (P. N. Lebedev Physical Inst., U.S.S.R.). Soviet Phys. JETP 3, 132-3 (1956) Aug. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 207-9(1956) Jan. (In Russian)

Equations are derived for the excitation of synchrotron oscillations in strong-focusing accelerators. (B.J.H.)

RADIATION ABSORPTION AND SCATTERING

11546
ELASTIC SCATTERING OF PROTONS AT 31.5, 20, AND 14.5 MEV. B. B. Kinsey and T. Stone (Univ. of California, Berkeley). Phys. Rev. 103, 975-82(1956) Aug. 15.

A survey of the differential cross sections for the elastic scattering of protons has been made for protons of 31.5, 20, and 14.5 Mev. The angular distribution shows well-developed maxima and minima only for nuclei of intermediate atomic weight. For heavy nuclei, the diffraction effect is destroyed by the Coulomb scattering. With 31.5-Mev protons, the first minimum disappears for nuclei heavier than Zr; with 20-Mev protons, for nuclei heavier than V. In light nuclei, the maxima and minima are progressively obliterated as the mass number is reduced and the energy is increased. In the main, the angular distribution changes smoothly from one nucleus to another, the cross sections at the maxima increasing as the fourth power of the nuclear radius. However, these cross sections are not proportional to the energy, as would be expected from elementary diffraction theory. For intermediate nuclei, these cross sections are nearly independent of the energy; for nuclei from O to Mg they rise to a maximum near 20 Mev, and for light nuclei, they fluctuate in a less regular manner. (auth)

11547
ANALYSIS OF PROTON-PROTON SCATTERING DATA AT 300 MEV. M. H. Hull, Jr., J. B. Ehrman, R. D. Hatcher,

and L. Durand (Yale Univ., New Haven, Conn. and New York Univ.). Phys. Rev. 103, 1047-52(1956) Aug. 15.

An analysis of proton-proton scattering experiments is described and some results for 300 Mev are presented. Phase shifts for states with $J \leq 4$ are included, and effects of states of higher angular momentum are discussed. The importance of including Coulomb interference effects is brought out. (auth)

11548

PION-PROTON TOTAL CROSS SECTIONS FROM 0.45 TO 1.9 BEV. R. Cool, O. Piccioni, and D. Clark (Brookhaven National Lab., N. Y.). Phys. Rev. 103, 1082-97(1956) Aug. 15.

Measurements of the pion-proton total cross section over a range of kinetic energies from 0.45 to 1.9 Bev are described. Positive pions were distinguished from protons of the same momentum by a time-of-flight technique. A liquid hydrogen absorber was used for most of the measurements. Muons, the principal beam contamination, were approximately 10% of the pions. A pronounced maximum for $\sigma(\pi^-,p)$ near 0.9 Bev, which had been noted in our preliminary measurements, is confirmed by data presented here. If this maximum is to be interpreted as a resonance in a single state of angular momentum, the analysis shows that, after subtracting a term which can reasonably be attributed to nonresonant states, the total angular momentum could be as low as $\frac{5}{2}$ without serious disagreement with experimental data. The possibility of explaining this maximum with a resonant pion-pion interaction as conjectured by Dyson and Takeda is discussed. The measurements of $\sigma(\pi^+,p)$ also give evidence for the existence of a maximum of relatively smaller amplitude at 1.35 Bev. The differential cross sections in the forward direction for elastic and charge-exchange scattering of pions by protons have been obtained by making use of the dispersion relations. (auth)

11549

PHASE SHIFTS FOR PION-NUCLEON SCATTERING AT 40 MEV. F. Mandl (Univ. of Rochester, N. Y.). Phys. Rev. 103, 1098-1101(1956) Aug. 15.

Approximate phase shifts for the pion-nucleon system are obtained from the Chew-Low-Wick equations. At 40 Mev, the set of phases: $\delta_1 = 6.26°$, $\delta_3 = 4.2°$, $\delta_{11} = -2.05°$, $\delta_{13} = \delta_{31} = -0.82°$, and $\delta_{33} = 4.1°$, has the properties: (i) it satisfies the first iteration and the effective-range approximations of the Chew-Low-Wick equations, (ii) it satisfies the dispersion relations, (iii) it gives good over-all agreement with the experimental data within the experimental errors. Iteration of the effective-range approximation, for energies up to 200 Mev, gives good agreement for the δ_{13} and δ_{33} phases but not for the δ_{11} phase shifts. (auth)

11550

PROTON-PROTON SCATTERING AT 147 MEV. J. M. Cassels (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A69, 495-6 (1956) June 1.

The 90° differential proton-proton scattering cross section was remeasured at 147 Mev with improved apparatus. The results gave a value of 4.05 ± 0.28 mbn sterad^{-1}. (B.J.H.)

11551

THE NUCLEAR SCATTERING OF 0.4 AND 0.5 MEV ELECTRONS IN COMPOSITE ALUMINIUM–URANIUM FOILS. B. Brown, E. Matsukawa, and E. A. Stewardson (Univ. Coll. of Leicester, England). Proc. Phys. Soc. (London) A69, 496-9(1956) June 1.

The results are given of experiments on the scattering of 0.4- and 0.5-Mev electrons at 90 and 105° by U. The U metal was sputtered on to thin Al foil, and the scattering produced by the composite foil was measured. Results were in very good agreement with theory. (B.J.H.)

11552

ON THE ENERGY LOSS AND SPECIFIC IONIZATION OF A RELATIVISTIC PARTICLE IN A POLARIZABLE MEDIUM. I. P. Budini (Univ. of Trieste) and L. Taffara (Univ. of Padova). Nuovo cimento (10) 4, 23-45(1956) July.

The average total energy loss of a particle on passing through a polarizable medium has been calculated by introducing into the theory of Fermi an expression for the dielectric constant which is apt to represent both the dispersive and absorptive properties of the medium. The average total energy may then be divided into the average energy lost as excitation, Cherenkov radiation and primary ionization of the atoms of the medium. The effect has been calculated of the polarizability of the medium on the number of ions generated by the ionizing particle per unit length and on the number of events in which an atomic electron has been emitted with energy greater than a certain threshold energy. These numbers show a logarithmic increase at relativistic energies and a subsequent saturation caused by the polarizability of the medium, both dependent on the threshold energy. (auth)

11553

MESON NUCLEON S SCATTERING AND CROSSING THEOREM. A. Martin (Univ. of Paris). Nuovo cimento (10) 4, 369-89(1956) Aug.

It is noted that the low energy S-wave calculations of meson-nucleon scattering cannot be very satisfactory if they do not obey the "crossing theorem". It may be interesting to modify the iteration treatments in order to satisfy the symmetry requirements. For this purpose, the series of scattering processes considered is completed by a new series in which the initial meson and the final meson are excahnged. In this way, Lévy's covariant treatment of S wave scattering is generalized. The result of the calculation is deeply modified by the introduction of these new processes. It is not possible to get a quantitative agreement with experiment. The signs of the phase shifts, however, are correct near $G^2/4\pi = 15$. The approximations used in solving the integral equations are discussed by comparison with other calculations. (auth)

11554

SCATTERING OF FAST NEUTRONS BY SEMI-TRANSPARENT NONSPHERICAL NUCLEI. E. V. Inopin (Physico-technical Inst., Ukrainian S.S.R.). Soviet Phys. JETP 3, 134-6(1956) Aug. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 210-12(1956) Jan. (In Russian)

RADIATION EFFECTS

11555 APEX-261

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

RADIATION DAMAGE TO ELASTOMERS, PLASTICS, AND ORGANIC LIQUIDS. C. G. Collins and V. P. Calkins. Sept. 1956. 245p. Contracts AF-33(038)-21102 and AT-(11-1)-171. $1.25(OTS).

Experimental data on radiation damage to elastomers, plastics, and organic liquids are compiled. Preliminary considerations, factors in radiation damage, dosage conversion, calculation methods, and relation of dosage to viscosity are included. (T.R.H.)

11556

VACANCIES AND DISPLACEMENTS IN A SOLID RESULTING FROM HEAVY CORPUSCULAR RADIATION. W. S. Snyder (Univ. of Tennessee, Knoxville and Oak Ridge National Lab., Tenn.) and Jacob Neufeld (Oak Ridge

National Lab., Tenn.). Phys. Rev. 103, 862-4(1956) Aug. 15.

The number of displacements D(E) and the number of vacancies V(E) produced in a monatomic solid as a result of collisions due to an incident ion of initial energy E, are obtained as solutions of the equation $f(E) = \int_0^E dy K(E,y) \times \{p(y)[f(y-\alpha) + 1 - \theta q(E-y)] + [1 - p(E-y)q(y)]f(y)\}$, where $f(E) = D(E)$ or $V(E)$, $p(y)$ denotes the probability that a struck atom is displaced when it has received energy y, $q(E-y)$ is the probability that the striking atom replaces it if displacement has occurred, $K(E,y)$ is the scattering kernel, and α is the minimum amount of energy that is assumed to be necessary to displace an atom (it is assumed that the struck atom loses energy α in breaking away from its lattice site). In the equation, $f(E) = 0$ for $E < \alpha$, with $\theta = 0$ for displacements and $\theta = 1$ for vacancies. This equation is solved for some representative cases of p(y) and q(y). The functions p(y) and q(y) can be chosen to fit experimental estimates of either D(E) or V(E) singly but indicate a fundamental discrepancy of the joint estimates. The discrepancy, if not due to inaccuracy in the interpretation of experimental results, suggests that a mathematical model based on individual collisions is adequate. (auth)

11557

IONIC DISORDER IN X-IRRADIATED KBr CRYSTALS. H. Rüchardt (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 103, 873-6(1956) Aug. 15.

The production by x rays of anion vacancies in KBr crystals was studied quantitatively in the liquid helium temperature range. The thermal stability of the vacancies was investigated in detail. A series of recombination steps was observed in the 10 to 30°K region associated with activation energies of the order of 0.03 to 0.09 ev. A green luminescence was observed during the irradiation by x rays and during the annealing of the crystals. This luminescence is attributed to electronic recombinations rather than to vacancy recombination. A semiquantitative electrostatic model is proposed to explain the very limited thermal stability of single vacancies. This analysis predicts remarkably high local concentrations of vacancies. (auth)

RADIOACTIVITY

11558 TT-631

GAMMA RADIATION OF COBALT-60. (γ-Izluchenie Co^{60}). B. Dzhelepov, N. Zhukovskii, and Iu. Khol'nov. Translated by G. Belkov from Doklady Akad. Nauk S.S.S.R. 77, 233-6(1951). 9p.

11559

ON THE PROBABLE EXISTENCE OF UNKNOWN RADIOACTIVE BODIES EMITTING VERY SHORT RANGE α PARTICLES. Rene Coppens. Compt. rend. 243, 582-4 (1956) Aug. 6. (In French)

Certain solutions of iron salts, impregnating photographic nuclear emulsions, give rise to very short range α rays (3 or 4 μ, 10 and 14 μ), which allows the expression of the hypothesis of the existence of unknown α radioactivities. (tr-auth)

11560

RADIOACTIVITY OF AIR AND PRECIPITATIONS. Hubert Garrigue. Compt. rend. 243, 584-5(1956) Aug. 6. (In French)

Since May 31, 1956, all the precipitations at the summit of the Puy-de-Dome, have been contaminated with artificial radioactive products. The flight survey of June 15 confirms these results. (tr-auth)

11561

CONVEYOR BELT METHOD FOR STUDYING SHORT-LIVED ACTIVITIES: Ag^{108}, Ag^{110}, AND In^{116}. M. C. Joshi and B. V. Thosar (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci. 43A, 255-64(1956) May.

A device, consisting of a rapidly rotating circular hoop with the neutron source and the detector at opposite ends of a diameter, was used to measure activities with half-lives ranging from a second to several minutes. (F. S.)

11562

HALF-LIVES OF SHORT-LIVED ACTIVITIES WITH A PULSED NEUTRON SOURCE AND A TEN CHANNEL TIME ANALYSER. N. Veeraraghavan (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci. 43A, 319-26 (1956) May.

The half-lives of He^6 and Pb^{207m} have been measured by pulsing the neutron source from a 1-Mev cascade generator and observing the decay with a ten channel cathode ray tube time analyser. A scintillation counter with anthracene crystal served as the detector. Using least squares fitting, the half-lives of He^6 and Pb^{207m} were found to be respectivelv 0.852 ± 0.016 second and 0.948 ± 0.014 second. Comparison with previous determinations is given. (auth)

11563

RADIOACTIVE DECAY OF La^{137} AND Ce^{137}. A. R. Brosi and B. H. Ketelle (Oak Ridge National Lab., Tenn.). Phys. Rev. 103, 917-20(1956) Aug. 15.

A long-lived radioactive isotope of lanthanum has been produced by neutron bombardment of natural cerium. It decays with emission of Ba x rays and has been assigned as La^{137}. The K-electron capture half life is $(6 \pm 2) \times 10^4$ yr calculated from the Ba K x ray intensity and the yield of mass 137 atoms in the bombardment. Approximate measurements of neutron cross sections of Ce^{136} gave 6.3 barns for activation of Ce^{137} and 0.6 barn for activation of Ce^{137m}. A previously unobserved 10-kev M1 transition has been discovered in the decay of Ce^{137}. A decay scheme is proposed which has a $g_{7/2}$ ground-state spin assignment for La^{137}. Electron capture to the $d_{3/2}$ ground state of Ba^{137} on the basis of this assignment is second-forbidden. (auth)

11564

PROBABLE ABSENCE OF K CAPTURE IN THE DECAY OF LEAD-205. R. H. Herber, T. T. Sugihara, C. D. Coryell, and W. E. Bennett (Massachusetts Inst. of Tech., Cambridge) and J. R. Huizenga (Argonne National Lab., Lemont, Ill.). Phys. Rev. 103, 955-6(1956) Aug. 15.

A number of experiments designed to detect the K-capture decay of Pb^{205} are discussed. No K x-ray activity which would be ascribed to Pb^{205} was observed in deuteron-bombarded natural lead or neutron-irradiated 25.7% Pb^{204}. From these results, the L-capture half life of Pb^{205}, and its absence in natural lead, it is concluded that Pb^{205} does not decay by K capture with a half life in the range 2 seconds $< t_{1/2} < 10^{10}$ years. (auth)

11565

DECAY OF NEUTRON-DEFICIENT ISOTOPES OF Pd AND Rh. Seymour Katcoff and Henry Abrash (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 966-70 (1956) Aug. 15.

Pd isotopes of masses 98, 99, and 101 were prepared by α-particle bombardment of ruthenium. The radiations of these isotopes and of their Rh daughters were investigated with a scintillation coincidence spectrometer. Rh^{98} decays with a half life of 8.7 ± 0.1 minutes by emission of 2.5 ± 0.2-Mev positrons in coincidence with 650 ± 10-kev γ rays. Its Pd^{98} parent was shown by successive daughter extractions to decay with a half life of 17.5 ± 0.5 minutes. Rh^{99} (4.7 ± 0.1 hours) showed 0.74-Mev positrons (10%) in coincidence with 335 ± 10-kev γ rays (70%). Other γ rays

were observed at 615 ± 15 kev (20%), 890 ± 20 kev (weak line coincident with 335-kev γ), 1.26 ± 0.03 Mev, and 1.41 ± 0.04 Mev (weak). Pd^{99} (21.6 ± 0.6 minutes) was identified by successive Rh daughter extractions. Its maximum positron energy is 2.0 ± 0.1 Mev and the following γ rays were observed: 140, 275, 420, and 670 kev. The 140-kev γ ray is the most intense and the 420-kev peak represents two γ rays of about the same energy in cascade Rh^{101} (4.7 ± 0.2 days) decays by electron capture followed by emission of 312 ± 10 kev γ rays. Pd^{101} (8.5 ± 0.3 hours) emits 0.58 ± 0.04 Mev positrons (4%) by decay to the ground state of Rh^{101}. The γ rays observed were at 288 kev (15%), 590 kev (15%), 720, 1190, and 1280 kev (last three less intense). The photopeak at 288 kev represents two coincident γ rays of about the same energy. Tentative spin and parity assignments were made for the ground states of the nuclides investigated. Mass assignments were confirmed by a study of the relative yields of the various radioactive isotopes as the bombarding α-particle energy and isotopic composition of the Ru target were varied. (auth)

11566

DECAY CONSTANTS OF K^{40} AS DETERMINED BY THE RADIOGENIC ARGON CONTENT OF POTASSIUM MINERALS. G. W. Wetherill, L. T. Aldrich, and G. R. Tilton (Carnegie Institution of Washington, D. C.); G. J. Wasserburg (Univ. of Chicago); and R. J. Hayden (Argonne National Lab., Lemont, Ill.). Phys. Rev. 103, 987-9(1956) Aug. 15.

It is shown that the potassium-argon age of young minerals depends almost linearly on the decay constant for electron capture in K^{40} and is very insensitive to the decay constant for beta emission. This fact permits calculation of λ, by comparing the concordant uranium-lead age of cogenetic uraninite with A^{40}/K^{40} ratios found in young samples of mica. It is found that $\lambda_e = (0.557 \pm 0.026) \times 10^{-10}$ yr^{-1}. Similar comparisons with older mica samples indicate that satisfactory agreement with the uraninite ages are obtained by use of this value of λ_e, together with $\lambda_\beta = (0.472 \pm 0.05) \times 10^{-9}$ yr^{-1}. It is concluded that there is no conflict between the decay constants inferred by this geological method and those found by direct counting experiments. (auth)

11567

DECAY SCHEME OF La^{138}. W. Turchinetz and R. W. Pringle (Univ. of Manitoba, Winnipeg, Canada). Phys. Rev. 103, 1000-3(1956) Aug. 15.

The methods of scintillation spectroscopy have been applied to the naturally occurring radionuclide La^{138}. It is shown that La^{138} emits gamma radiation of energies 1.43 ± 0.01 and 0.81 ± 0.01 Mev. Coincidence studies show that the 1.43-Mev radiation is correlated in time with an observed Ba K x-ray (32 ± 1 kev), but not with the 0.81-Mev gamma ray. A decay scheme is proposed in which La^{138} undergoes electron capture to the first excited level of Ba^{138} at 1.43 ± 0.01 Mev with a partial half-life of $(2.1 \pm 0.1) \times 10^{11}$ years and an L/K ratio of 1.4 ± 0.25, and negatron decay to an excited level of Ce^{138} at 0.81 Mev with a partial half-life of $(2.4 \pm 0.2) \times 10^{11}$ years. Consideration of beta decay systematics suggest that in each case the transition energy is low. The total half life is estimated to be $(1.0 \pm 0.1) \times 10^{11}$ years. (auth)

11568

HIGHLY EXCITED ROTATIONAL STATES OF SOME NUCLEI. INTENSITY OF α DECAY TO ROTATIONAL EXCITED LEVELS. L. L. Goldin, G. I. Novikova, and E. F. Tretyakov (Academy of Sciences of U.S.S.R., Moscow). Phys. Rev. 103, 1004-8(1956) Aug. 15.

The α spectra of Pu^{240} and U^{233} have been investigated. A more precise value $(8.5 \pm 1.5) \times 10^{-4}$, for the intensity of the Pu^{240} α line corresponding to the transition to the 4+ level of the daughter nucleus has been obtained. New α lines corresponding to the levels with energies 164 kev (0.07 _ 0.04%) and 237 kev (0.04 ± 0.02%) have been found in the α spectrum of U^{233}. Thus, successive transitions to rotational levels starting from the ground level (spin 5/2) and up to the level with spin 15/2 have been observed. Earlier results on the α decay of Am^{241} (on the population of the levels between 5/2 and 13/2) are used in the discussion. The α-line intensities are compared with available theoretical formulas. (auth)

11569

HALF-LIFE OF Rb^{87}. L. T. Aldrich, G. W. Wetherill, G. R. Tilton, and G. L. Davis (Carnegie Institution of Washington, D. C.). Phys. Rev. 103, 1045-7(1956) Aug. 15.

A comparison of the ratio, radiogenic Sr^{87}/Rb^{87}, found in eight Rb minerals of differing Rb content from the same rock unit has shown this ratio to be constant for a given mineral assemblage. This ratio has been measured on Rb minerals from six rock units for which concordant U – Pb ages ranging from 375 to 2700 million years have also been obtained. From the ratio radiogenic Sr^{87}/Rb^{87} and the age of the mineral obtained from the U – Pg age, the half life of Rb^{87} is calculated to be $(5.0 \pm 0.2) \times 10^{10}$ yr. This lies in the range of values found by direct counting experiments. (auth)

11570

ABSOLUTE ALPHA COUNTING OF ASTATINE-211. J. K. Basson (Brookhaven National Lab., Upton, N. Y.). Anal. Chem. 28, 1472-4(1956) Sept.

A method has been developed for the absolute standardization of the α-emitter At^{211}. The isotope is dissolved in the liquid scintillator of a scintillating counter, thereby avoiding the usual difficulties due to absorption and scattering of the alpha particles. When a solution of 50 g/l of diphenyloxazole in p-dioxane was used, more than 1 ml. of water could be added before the efficiency of the counter was impaired. (auth)

11571

DETECTION OF ^{103m} Rh IN THE "BIKINI ASHES". Kenjiro Kimura, Nagao Ikeda, and Kenji Yoshihara. Bull. Chem. Soc. Japan 29, 395-8(1956) Apr.

Rhodium^{103m} having very short half life (57 m) and very low energy in electron conversion (0.034 Mev) was searched for and detected in the "Bikini Ashes". It was separated from the ashes by the method using the cation exchange resin, Dowex-50, and its activity was measured by the 2π Q-gas flow counter. The radionuclides detected in the ashes are briefly summarized in a table. (auth)

11572

RADIONUCLIDES IN FUSED ENAMEL MAKE STABLE RADIATION SOURCES. Clifton Blincoe (Univ. of Missouri, Columbia). Nucleonics 14, No. 8, 82-3(1956) Aug.

A technique is presented for making stable sources of radionuclides (for example Sr^{90}). The radionuclides are mounted as components of a fused enamel in a manner similar to that used for applying decorative enamels to small jewelry. (W. L. H.)

11573

NUCLEAR DISINTEGRATION. S. M. Ayub. Pakistan J. Sci. 8, No. 3, 117-25(1956) May.

Theories of α and β emission are offered. To explain α emission it is assumed that the axes of two neutron-proton pairs are at right angles within the nucleus, and on emission the axes become parallel. The author explains β emission by abandoning the hypothetical neutrino and postulating the "pseudotron," equal in mass to the electron, spin one-half,

charge zero, which must be emitted simultaneously with an electron or positron. (T.R.H.)

11574

THE LONG β-LIFETIME OF ^{14}C AND THE ^{14}N SPECTRUM. J. P. Elliott (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (8), 1, 503-17(1956) June.

The long β lifetime of C^{14} and the spectrum of N^{14} are explained using a small tensor force in addition to the usual central and spin-orbit forces. The γ decay branching ratio of the 3.95 Mev level of N^{14} is predicted and also the nucleon reduced widths for the low levels of N^{14} and N^{15}. (auth)

11575

ANGULAR CORRELATIONS BETWEEN SUCCESSIVE CONVERSION ELECTRONS IN ^{80}Br. E. Breitenberger (Cavendish Lab., Cambridge, England). Proc. Phys. Soc. (London) A69, 453-63(1956) June 1.

The angular correlation between the successive K-conversion electrons from the de-excitation of 4.4-hour Br^{80} has been investigated, using anthracene scintillation spectrometers in conjunction with coincidence single-channel kicksorters. Disturbing side effects were kept under control by a special procedure of taking data. The correlation function contains only a second-order term with $\alpha_2 \simeq +0.30$. This is consistent with the assignment M3/E1, and excludes M3/(M1 + E2). Shell theory then makes the intermediate and ground levels of the cascade $f_{\frac{5}{2}} g_{\frac{9}{2}}$ and $p_{\frac{3}{2}} p_{\frac{1}{2}}$, respectively, but cannot account for the isomeric level (which must be 5^-). The experimental method used in this work can be applied to other e–e cascades. (auth)

11576

PREPARATION OF THIN BETA-RAY SOURCES BY CATHODE SPUTTERING. T. Novakov and M. Mladjenovic (Institute for Nuclear Sciences "Boris Kidrich," Belgrade, Yugoslavia). Rev. Sci. Instr. 27, 415-16(1956) June.

A method of preparing thin β-ray sources was developed based on the phenomenon of cathode sputtering. The arrangement used was highly polished Al electrodes placed in an evacuated glass cylinder. The distance is adjustable through O-ring seals. The source holder is introduced through ground conical joints and placed between the electrodes. The voltage on the electrodes was 1000 v. The current was 30 m a. The pressure was less than 10^{-2} mm, since for higher values the sputtering rate decreases. (W. L. H.)

11577

LAMONT NATURAL RADIOCARBON MEASUREMENTS. III. W. S. Broecker, J. L. Kulp, and C. S. Tucek. Science 124, 154-65(1956) July 27.

A study made with CO_2 and acetylene indicated that proportional gas-counting methods have distinct advantages over other methods. The results obtained by the black-carbon method and those obtained by the new CO_2 proportional-counting method are reported. Age estimations made with natural radiocarbon measurements are tabulated. Samples are grouped according to the primary field of interest and by the method used in the assay. (auth)

11578

AUGER EFFECT IN HEAVY ATOMS. V. N. Mokhov and M. G. Urin (Moscow Physico-engineering Inst.). Soviet Phys. JETP 3, 133-4(1956) Aug. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 209-10(1956) Jan. (In Russian)

RARE EARTHS AND RARE-EARTH COMPOUNDS

11579 ISC-702

Ames Lab., Ames, Iowa.

SOME PHYSICAL-METALLURGICAL PROPERTIES OF SCANDIUM, YTTRIUM AND THE RARE EARTH METALS. Kenneth W. Herrmann, A. H. Daane, and F. H. Spedding. Aug. 1955. 98p. Contract W-7405-eng-82.

The crystal structures and precision lattice parameters of rare earth metals were investigated. High purity metals were examined by powder, single crystal and back reflection x-ray-diffraction techniques. All but four of the back reflection samples were prepared by distillation in high vacuum (approximately 2×10^{-7} mm Hg). The back reflection examinations, by which very accurate lattice parameters can be determined, were considered necessary if quantitative comparisons of the properties of the rare earths are to be made. Although Sc and Yt are not classified as rare earths, they are similar in their behavior. From the crystallographic data of Sc, Yt and the rare earth metals the mole-atomic volume, density, axial ratio and metallic radii were calculated for each element and then graphically compared. In addition to the expected variations in these properties throughout the series due to structure differences and the "lanthanide contraction," other irregularities were also observed. These cannot be satisfactorily explained at present. Microscopic examinations of the distilled metals revealed strong evidence for the existence of twinning. Considerable confusion exists in the literature concerning the phase transformations exhibited by the lighter rare earth metals. To obtain further information concerning these phenomena the transformation temperatures of pure La, Ce, Pr and Nd were determined by investigating the electrical resistivities of these metals as a function of temperature. They were studied over the temperature range 20°C to approximately 100°C below their melting points. The data are presented in graphical form. High temperature crystallographic studies still in progress have shown the intermediate phase of La to be f.c.c. with a lattice parameter of $a_0 = 5.31$ A at about 260°C. At present no definite information concerning the high temperature structures has been obtained. (auth)

SHIELDING

11580 BNL-390

Brookhaven National Lab., Upton, N. Y.

THE TRANSMISSION OF NEUTRONS THROUGH DUCTS IN WATER. F. J. Shore and R. D. Schamberger. Mar. 1, 1956. 51p. $0.35(OTS).

The Brookhaven Shielding Facility has been utilized to study the transmission of fission neutrons through air ducts in a water shield. The program included the study of the transmission properties of ducts of two different basic geometries, plane slots, and right circular cylinders. The following report represents an effort to systematize and interrelate the various results of the investigation. (auth)

11581 EDI-19

[Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.]

CORRECTION FOR BUILD UP FACTOR FOR LEAD AND STEEL SHIELDING FOR 1 MEV AND 1.3 MEV γ RADIATION. P. B. Aitken. [1955?]. 6p. (J-102-1).

Gamma shielding values for lead and steel for two common energy values, 1 Mev and 1.3 Mev, have been calculated and plotted graphically together with values uncorrected for build-up. (W.L.H.)

11582

THE STREAMING OF NEUTRONS IN SHIELDS. Edward Fisher (Avco Advanced Development Div., Stratford, Conn.). Nuclear Sci. and Eng. 1, 222-38(1956) July.

The streaming of neutrons in narrow channels through thick shields is treated theoretically, using one-velocity diffusion theory. Scattering by the channel walls is eval-

uated, and it is shown how the entrance and exit of a channel affects its streaming current. The cases examined are the straight duct, gap, and annulus, offsets for the gap and annulus, and bends for the duct and gap. In all cases simple, approximate formulas are obtained. (auth)

SPECTROSCOPY

11583
FORMATION OF MIXED CRYSTALS IN THE USE OF THE ALKALI-HALIDE DISK TECHNIQUE FOR PREPARING SAMPLES OF $KAu(CN)_2$ FOR INFRARED SPECTRA. Llewellyn H. Jones and Mark M. Chamberlain (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 25, 365-6(1956) Aug.

Reported changes in spectra observed in samples prepared by the alkali-halide disk technique are investigated and attributed to formation of mixed crystals. Sample disks of $KAu(CN)_2$ were prepared, and observation showed changes occurring in KI and KBr disks with time. There was no change in the KCl disks. Three possible reactions are offered and all but one, incorporation of $Au(CN_2)^-$ into the cubic KX lattice, ruled out. The replacement of a $\underline{K}^+$ and $2\underline{X}^-$ by $Au(CN)_2^-$ in the KBr or KI lattice is substantiated. (T. R. H.)

11584
POLARIZED INFRARED SPECTRUM OF $KAg(CN)_2$. Llewellyn H. Jones (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 25, 379-80(1956) Aug.

The value of the angle of inclination with the $\underline{C}$ axis of the $\underline{NCAgCN}$ groups in $KAg(CN)_2$ as determined from the polarized infrared spectrum of a single crystal is reported. The average of 8 results is 28°, in good agreement with x-ray studies and essentially the same as for $KAu(CN)_2$. (T. R. H.)

11585
ANALYSIS OF THE ABSORPTION AND FLUORESCENCE SPECTRA OF URANYL SALTS. PART I. URANYL ACETATE (ABSORPTION). V. Ramakrishna Rao and K. V. Narashimham (Andhra Univ., Waltair, India). Indian J. Phys. 30, 334-47(1956) July.

The absorption spectrum of uranyl acetate was analysed as consisting of two systems involving two transitions from two excited states to a common ground state. The separation between these two excited states was found to be ν 1839 cm^{-1} or 0.228 ev. System I was explained on the basis of a (0,0) band at ν 20589 cm^{-1} and two upper state fundamentals 735 and 36 cm^{-1} and three lower state fundamentals 856, 210 and 30 cm^{-1}. System II was explained on the basis of a (0,0) band at ν 22428 cm^{-1} and the upper state fundamentals 711 and 212 cm^{-1} and the ground state fundamentals 841 and 228 cm^{-1}. (auth)

Refer also to abstract 11064.

THEORETICAL PHYSICS

11586 AEC-tr-2608
SOME QUESTIONS OF RELATIVISTIC HYDRODYNAMICS. I. M. Khalatnikov. Translated from Zhur. Eksptl'. i Teoret. Fiz. 27, 529-41(1954). 12p.

A variational method is developed for finding the equations of relativistic hydrodynamics. The relativistic analog of potential motion is found and the form of the Bernoulli equation for this motion is clarified. The properties of a relativistic adiabatic shock and the propagation of large-amplitude sound waves are investigated. The exact solution of the general one-dimensional problem in relativistic hydrodynamics is found. (auth)

11587 AEC-tr-2613
REMARKS ON THE THEORY OF FUSION. G. A. Sokolik. Translated from Zhur. Eksptl'. i Teoret. Fiz. 28, 13-16 (1955). 6p.

A generalization of de Broglie's theory of fusion which holds for infinite-dimensional equations is given. (auth)

11588
THERMODYNAMIC THEORY OF IRREVERSIBLE PROCESSES. I. THE BASIC MACROSCOPIC CONCEPTS. Donald G. Miller (Brookhaven National Lab., Upton, N. Y.). Am. J. Phys. 24, 433-44(1956) Sept.

The foundations of the thermodynamic theory of irreversible processes are presented in macroscopic terms. The concept of entropy production in systems with gradients is discussed in relation to classical thermodynamics and to what new hypotheses are necessary. The entropy production is computed in some simple cases, and it is found that its factors can be related to well-known linear laws such as Ohm's. It is shown on experimental grounds that the linear laws must be generalized in complex cases involving interacting flows. Further appeal to experiment shows that the Onsager relations must be valid. The range of validity of the theory is discussed. (auth)

11589
REMARKS ON THE CLASSIFICATION OF FUNDAMENTAL PARTICLES. F. Cerulus (CERN Theoretical Study Div., Copenhagen). Nuclear Phys. 1, 557-70(1956) July.

Starting from a few experimentally observed reactions and the assumed existence of strong, electromagnetic and weak interactions, a correspondence between all fundamental particles and a certain Abelian group is set up, without referring to any details of the interaction. This formalism allows the derivation of the selection rules for the production of hyperons, K mesons and π-mesons. The weak interactions of K mesons, pions, muons, and leptons are correctly described by the formalism, and the conservation of light fermions is derived from it. The relation between the rules for the production and those for the decay of the hyperons and K mesons is explained. (auth)

11590
A SOLUBLE MODEL OF MESON-NUCLEON S-STATE SCATTERING. E. L. Lomon (Weizmann Inst. of Science, Rehovoth, Israel). Nuovo cimento (10) 4, 106-22(1956) July.

The interaction Hamiltonian (1) $H_1 = g \int d_3x \bar{\psi}(x)\phi(x)\cdot\phi(x)\psi(x) + \lambda \int d_3x \bar{\psi}(x)(\pi(x) \times \phi(x))\cdot\tau\psi(x)$ is considered. There is evidence that for meson-nucleon scattering (1) represents a large part of the ps(ps) s-state interaction for intermediate as well as weak coupling, providing that λ/g is suitably altered. The first term of (1) has long been known to be diagonalizable in the static nucleon limit. The isotopic spin coupling of the second term requires that the isotopic spin variable of the nucleon be left free (non-static) thus complicating the diagonalization. By combining the nucleon spin operator with the meson field operators (1) was diagonalized. The parameters determined by experiment are reasonable. One can examine many formal aspects. The point source limit exists. (auth)

11591
NUCLEAR SATURATION AND TWO-BODY FORCES: SELF-CONSISTENT SOLUTIONS AND THE EFFECTS OF THE EXCLUSION PRINCIPLE. K. A. Brueckner and W. Wada (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 1008-16(1956) Aug. 15.

The equilibrium properties of uniform nuclear matter have been studied in previous papers by using a self-consistency method to determine two-body reaction matrices and the average effective one-particle potential which they generate. In this paper the self-consistency

method is simply illustrated by using some explicit examples. An investigation is also made of the previously neglected effects of the exclusion principle on transitions to intermediate states. A variational expression is used for the reaction matrix, utilizing as a trial function the wave function which is exact if the exclusion effect is neglected. Two-body potentials are used which simulate the actual forces, i.e., square wells with a repulsive core of 0.35 $\hbar/\mu c$, range of 1.15 $\hbar/\mu c$, and depth 98.3 Mev, acting on s-states only. It is found that for effective mass values of 0.5M and 0.6M, the reaction matrix is appreciably altered, particularly for low values of relative momentum. The requirements of self-consistency, however, almost entirely compensate for the change in the reaction matrices so that at normal density in the effective mass approximation the final result for the average binding energy is precisely the same as that obtained when exclusion effects are neglected. The reasons for this simple result are discussed. Further approximations are discussed which are suitable for more exact computations and which allow inclusion of the exclusion effects, the departures from the effective mass approximation, and the effects of "propagation off the energy shell." Approximation methods for a finite nucleus are discussed and a simplified Hartree-Fock method using "pseudo-potentials" (in the sense of Fermi) is described. (auth)

TRITIUM AND TRITIUM COMPOUNDS

Refer to abstract 11349.

URANIUM AND URANIUM COMPOUNDS

11592 BNL-407
Brookhaven National Lab., Upton, N. Y.
ACCUMULATION OF FISSION PRODUCTS FROM U^{235}.
A. K. Booth and D. Schweitzer. July 1956. 10p.
$0.15(OTS).

A relatively simple and direct method is presented for estimating the amounts (or concentrations) of the fission products of U^{235} as a function of: power level, flux, time of operation, and burn-up. Tables are given for the build-up in one hour, the times required to reach one % burn-up, and the equilibrium values for fission products based on a one-megawatt reactor operating at a flux of 10^{14} neutrons/cm^2/sec. The fission product concentrations for a 500-Mw reactor with a flux of 10^{15} neutrons/cm^2/sec which has been operated for 10,000 hr have also been tabulated. To obtain concentrations, 100 tons total inventory of Bi was assumed. (auth)

11593 HW-41343
Hanford Atomic Products Operation, Richland, Wash.
A MACRO GRAIN SIZE TECHNIQUE FOR URANIUM.
H. R. Gardner. Feb. 9, 1956. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A macro grain size technique was developed for estimation of the grain size of β heat-treated U. The macroetched sample is viewed through a modified Bausch and Lomb "Eyepiece for Grain Size Determination" at a magnification of 20 under bright field illumination. Eight replicas of the ASTM grain size grids, ranging from 0.2 to 0.9 mm average grain diameter were constructed and inserted in the rotating reticle of the eyepiece. A 20X grain size chart and a series of 20X grain size overlays were constructed. A more reproducible and meaningful estimate of grain size is obtained by this technique than the existing micro (100X) technique. (auth)

11594 KAPL-1548
Knolls Atomic Power Lab., Schenectady, N. Y.
SOLUBILITY, DETERMINATION, DIFFUSION AND MECHANICAL EFFECTS OF HYDROGEN IN URANIUM.
W. D. Davis. Aug. 1, 1956. 67p. Contract W-31-109-Eng-52. $0.40(OTS).

The solubility and rate of diffusion of H in U has been determined between 400 and 800°C and for pressures up to 1 atmosphere. The solubility in the α phase for biscuit U shows an anomaly which is believed to be caused by impurities present in the U. The analytical method which was used in this investigation is described and evaluated. A study of the effect of H concentration and temperature upon the ductility of U shows that H raises the transition temperature of U 55°C. Amounts of H as low as 0.3 ppm low the elongation of tensile specimens from 32 to 10% at room temperature. (auth)

11595
NEUTRON RESONANCE PARAMETERS AND TRANSMISSION MEASUREMENTS IN U^{235}. O. D. Simpson, R. G. Fluharty, and F. B. Simpson (Phillips Petroleum Co., Idaho Falls, Idaho). Phys. Rev. 103, 971-4(1956) Aug. 15.

Transmission measurements have been made for U^{235} with a resolution of 0.05 to 0.07 μsec/meter using the Materials Testing Reactor fast chopper, and resonances have been studied below 60 ev. Breit-Wigner parameters have been obtained for more than 40 resonances. Four new resonances have been found at 12.8, 28.6, 29.9, and 34.7 ev. The 25.7-ev resonance previously reported has been split into two resonances, 25.6 and 25.9 ev. The ratio of $\bar{\Gamma}_n^0/D$ for resonances below 50 ev was found to be $1.0 \pm 0.2 \times 10^{-4}$. The level spacing of 1.40 ± 0.15 ev is one of the smallest so far observed. Data on the distributions of Γ_n^0 are presented. (auth)

11596
THE FISSION OF URANIUM BY C^{13} IONS. F. Brown, M. R. Price, and H. H. Willis (Atomic Energy Research Establishment, Harwell, Berks, England and Univ. of Birmingham, England). J. Inorg. and Nuclear Chem. 3, 9-14(1956) Aug.

The relative yields of seventeen nuclides from the fission of natural uranium by C^{13} ions of maximum energy 100 Mev have been measured by radiochemical methods. The typical features of high-energy fission were observed: symmetric fission predominates; nuclides near to β stability have significant independent yields; approximately eleven nucleons are emitted. (auth)

Refer also to abstract 11195.